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JOHN F. KELLY, EDITOR

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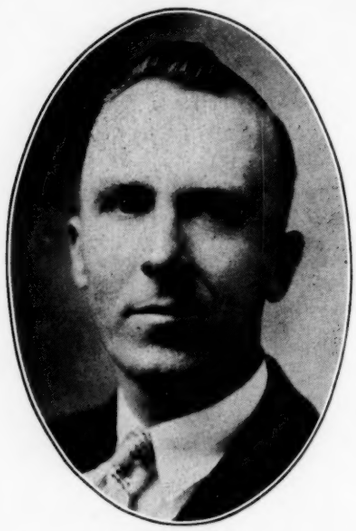

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EDITORIAL

"THE BOOK OF THE MONTH"

The Iron and Steel Engineer, in its January issue, is presenting to the Iron and Steel Industry a statistical number consisting of vital information and data, covering Mechanical, Lubrication, Electrical, Combustion and Metallurgical Operating practices.

The statistics furnished are also of value to equipment builders servicing the Iron and Steel Industry. Equipment builders will be able with the data and information furnished to acquaint themselves with the future potential markets for their particular type of equipment.

A careful analysis of this January number will also indicate the trend of the times, what the Steel Industry is thinking about and how they are bringing their plans to a successful conclusion.

While a perusal of these statistics shows the favorable operating position of the industry, on the other hand, when we look at the low steel production figure of the month, partly caused by seasonal and economic conditions, we find the Iron and Steel Industry is still confronted with its greatest problem, that is, "New Uses, New Outlets and New Markets for Steel Products." Our Industry is organized to the nth degree to process and produce but our methods of distribution must be reorganized. When it is taken into consideration that Seventeen Billions of Dollars are spent in one year in the United States for non-essentials and luxuries, it must or should be admitted that the Steel Industry could with profit enter into this field and attract a healthy portion of this capital for its finished products, thereby furnishing the user with a useful, beneficial, lasting and substantial product.

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A Review of 1933 Engineering Opinions

These engineering opinions expressed in papers and discussions which appeared in the 1933 issues of the Iron and Steel Engineer.

▲ By DR. E. F. NORTHRUP
Vice President and Technical Adviser, Ajax Electrothermic Corp., Trenton, N. J.

When inductive heating is employed it is important to consider whether the product to be heated is magnetic or non-magnetic. If a ferrous metal or alloy is to be heated under its decalescent point, the current and equipment needed will be quite different, in general, from what is required when the final temperature is carried above the point where magnetism is lost. All non-ferrous metals and alloys of similar form and size may be treated inductively in much the same way. Incidentally, I may remark that carbon and graphite can be heated inductively in much the same manner as non-magnetic metals and the temperature can be and has been carried to a point where graphite volatilizes. I shall, however, at this time confine myself strictly to a consideration of the inductive heating of solids which are metallic.

▲ By R. J. HARRY
Engineer, Alliance Machine Company, Alliance, Ohio

In every case when steel consumption decreases the demand for improved quality of steel increases. We are now in a period where the demand for high quality steel must be met. In order to meet this quality demand and to obtain a high percentage of practice from ingot to finished product, much experimenting is being done on big end up, hot top ingots. The advocates of this type of ingot claim a higher percentage of yield and superior quality.

▲ By WARREN C. HUTCHINS
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

Naturally, the application of Thyratron control is not a cure for all the ills of resistance welding, but it has eliminated one of the most serious variables with which one has previously been forced to contend—the inaccuracies of control devices with respect to time of power application. The proper application of Thyratron control will open fields for resistance welding which have to date been untouched, and when applied to resistance welding machines already in service, will insure welds of improved quality at greater and more economical speeds.

▲ By W. E. SMITH
Lubricating Engineer, National Refining Co., Cleveland, Ohio

Our problem is to prevent dripping from cranes now installed and in service in some cases for as long as twenty years. Twenty years ago mills were not making highly finished sheets and a spot or two on a sheet did not cause the material to be rejected unless it was to be galvanized or tinned. With the demand for a better finish on steel sheets and strip steel, these grease spots caused so much loss that it was necessary to find some way to prevent grease and oil from dropping from cranes.

▲ By W. P. SHEEHY
Maintenance Engineer, The B. F. Goodrich Co. Akron, Ohio

While oil and grease are the natural enemies of rubber and extreme care must be exercised in their application and use so as not to have them come in contact with either finished or unfinished products, drippage from overhead cranes and hoists is almost negligible when compared with trouble experienced in this respect from other types of mechanical equipment.

▲ By W. D. HODSON
President, The Hodson Corporation, Chicago, Ill.

The selection of the proper lubricants, no matter what the conditions, is exceedingly important. While it is always desirable to make one grease or lubricant or oil fulfill as many requirements as possible, there is certain equipment, such as overhead cranes, where the lubricant most suitable for the service should be used, even though it may result in more kinds of lubricants being used than is desired. The ordinary standard types of cup greases and gear shields are not suitable, and will not provide the maximum service possible with lubricants developed especially for such purposes.

▲ By H. W. BALL
Asst. Chief Engr., The Morgan Engineering Co., Alliance, Ohio.

While the one-shot lubrication systems have not yet won unanimous approval by crane users, it is our belief that these systems if properly applied and operated, have done more toward the proper lubrication and prevention of drippings from the crane bearings than any other method of lubrication.

▲ By T. SEDDINGER
Engineer, National Carbon Company, Inc. Cleveland, Ohio.

My remarks pertain to the old type of cranes where the problem reduces itself to two factors, namely, retaining the lubricant, and the use of lubricants capable of withstanding the conditions now encountered.

▲ By PHILIP KING
Engineer, Keystone Lubricating Co., Pittsburgh, Pa.

I have stated that there are lubricants on the market designed to lubricate the various moving parts of overhead cranes. These lubricants cannot

be entirely successful unless properly applied. I mean by this that there is a method whereby application counts as well as the quality of a lubricant. We cannot expect a cable lubricant that was designed to be a non-drip to remain entirely on the cables and sheave grooves if it has been excessively applied. Neither can we expect to properly lubricate gears when gear housings are leaky. I do not think we can expect to have a leak-proof gear cover but I do believe that with the proper lubricant, and a good gear housing that little trouble would be experienced with drippage from this source.

By F. C. HALLMARK
General Master Mechanic, Wheeling Steel Corporation, Steubenville, Ohio.

The next big problem in elimination of grease drippage is to educate operators to grease bearings properly. Whether they be the latest type anti-friction bearing or the old sleeve type, the general rule seems to be the same: they hook up a heavy grease gun and pump grease into the bearing until it begins to pop out around the journal or shaft due to several hundred pounds pressure inflicted with the gun. Naturally, the excess grease will work out of the bearing until the pressure on the inside becomes normal and finally finds its way to the floor.

By E. C. KIRKPATRICK
Mechanical Engineer, The Steel Company of Canada, Limited, Montreal, Canada

All cranes that have been installed within the last few years have been equipped with anti-friction bearings and no grease has ever dripped from them.

By A. J. DREYER
Dist. Sales Mgr., Harnischfeger Sales Corp., Pittsburgh, Pa.

The escape of oil or grease from bearings and gear cases on overhead mechanical and electrical equipment has always been something of a problem in those plants where appearance of product is highly important. Sheet and wire mills, paper, glass, marble, food, brass, copper and aluminum plants have all been obliged to give attention to this annoyance.

By S. A. NEWMAN
Chief Lubrication Engineer, Gulf Refining Co., Pittsburgh, Pa.

We find most line shafts driving the crane fitted with pressure gun fittings or with compression grease cups. In most cases we do not believe this is the best recommendation. We recommend the installation of gravity feed pin cups to feed a specially prepared semi-fluid grease. This not only gives excellent, economical lubrication, but does away with the hazard of forcing excessive grease out of the bearings which may later drop on material being handled.

By B. HANTMAN
Plant Engineer, Westinghouse Electric & Mfg. Co, East Pittsburgh, Pa.

During the past five years great strides have been made in the design of cranes, particularly that phase which includes the use of anti-friction bearings, properly designed gear cases and good joints in order to solve this problem.

By A. J. JENNINGS
General Sales Manager, The Farval Corp., Cleveland, Ohio.

The spoilage of materials caused by lubricant dripping from overhead traveling cranes, represents a direct loss in practically every steel mill and is a serious problem, particularly in the sheet mill.

By G. W. MILLER
President,
American Lubricants, Inc., Buffalo, N. Y.

In summing up let us say that proper, clean, crane lubrication depends upon four major things—proper design, re-design where necessary to good lubrication—proper attention and supervision—proper lubricant plus proper application.

By W. C. HEINLE
Engineer, Cleveland Crane and Engineering Co., Wickliffe, Ohio.

During the last year or two we have been experimenting on gear cases quite extensively. About two years ago we designed a gear case which has no machined surface and in which we use no packing and it has worked out very satisfactorily. We also have applied it to track wheel gears where gear is between bearings alongside the track wheel. Of course it requires a little more space between track and gear and where you have close clearance it does take a little longer shaft. But in very large installations we make a heavier shaft and have the larger bearing on the receiving side. We have applied this type in textile mills and several other cases where it was essential that oil would not drop, and it has given very satisfactory results. For quietness of operation, we have used solid herringbone gears running in oil and found that they are satisfactory. We have used herringbone gears on cranes where we wanted to get good speed reduction.

By H. S. GRIFFITH
Cranes Sales Engineer, Shaw-Box Crane & Hoist Corp., Pittsburgh, Pa.

There are many times more old style cranes in use than there are modern ones, with the unavoidable result that many crane users continue to be inconvenienced with oil and grease drippage. Crane equipment as a whole throughout the country is probably in worse condition than is any other single line of shop equipment, regardless of the fact that crane builders have kept step with improvements made on other lines. As a representative of the crane manufacturers, I have no hesitation in saying that oil and grease leakage from cranes, as well as other troubles experienced in old designs, have received the utmost consideration of crane designers, with the result that cranes as built today are a worthy product of the modern engineer.

By A. F. BREWER and E. A. HARPER
Mechanical Engineers, The Texas Company

The extent to which dripping of lubricants may occur will, of course, depend upon the design of the equipment. In some of the most modern installa-

tions of overhead electric cranes, it has been noticed that it still prevails, although not to as great an extent as in older types of machines, due to the fact that equipment manufacturers have given considerable thought to this feature in design and construction. It still remains, however, as a potential detriment and in most cases it can be attributed directly to one of three causes, namely, excess application of lubricant, use of improper lubricants, or carelessness in handling lubricants during the process of application.

By MAURICE RESWICK
Chief Engineer, Pennsylvania Lubricating Co., Pittsburgh, Pa.

The evil of drippage of lubricant from overhead cranes is a heritage from the time when it was customary to give lubrication only casual attention in machine design. Wherever you have waste-packed bearings, open gears and screw-type grease cups, you have to contend with the evil of drippage and leakage of greases and oils, particularly when the correct lubricant is not used.

By S. B. TERRY
Asst. Mgr., Gage Division, Pratt & Whitney Company, Hartford, Conn.

When mills are operated at 125 feet per minute rolling speed, it is possible to use the ordinary hand micrometer to measure thickness of strip. When this speed is stepped up to 350 or 400 feet per minute some other method of measuring becomes a necessity. The continuous gage operates satisfactorily.

By C. J. DUBY
Assistant Chief Engineer, Republic Steel Corp., Warren, Ohio.

The crane manufacturers have given considerable study to this problem so as to build cranes of a design that will prevent the dropping of grease and oil. The use of roller bearings on cranes of late design has almost entirely eliminated this trouble. Furthermore, I believe that controlled lubricating systems will lend themselves in a helpful manner in this instance. However, we still have the older type cranes in our plant, and therefore, had to find ways and means to prevent the oil and grease from dripping.

By E. C. CLEARY
Chief Electrician of the Toronto, Ohio, Plant of Follansbee Brothers Company.

The spoilage of finished material due to the dripping of oil and grease from overhead cranes and runways has been the subject of considerable discussion among steel mill officials, particularly those concerned with finished and semi-finished products.

By MARTIN J. CONWAY
Fuel Engineer, Lukens Steel Company, Coatesville, Pa.

During times of stress the raw material industries suffer the most. This is particularly true of the coal, iron and steel industries. Our national industrial growth began with coal and is sustained on coal and it is only in recent years that the coal industry itself has ceased to share in the prosperity to which it has contributed. While industrial depression is the main cause of the difficulties of the coal industry, no single cause can be accepted as covering the whole case, and no single cure can be adequately applied.

By G. R. McDERMOTT
Vice President, Surface Combustion Corp., Toledo, Ohio.

The advantage of heating by luminous flames is universally recognized on account of the great heat radiating power resulting in increased production at lower temperature differentials. The luminosity is due, of course, to the presence of free carbon which not only increases the radiation power of the flame but has a beneficial effect on the surface of the steel being heated. The inherent characteristics of the luminous flame as ordinarily produced are not definitely defined, therefore difficult to control resulting in poor temperature distribution, and occasionally results in high fuel consumption and excessive scaling of the steel being heated.

By JOHN L. YOUNG
Pittsburgh District Manager, Timken Roller Bearing Company, Canton, Ohio.

One of the most important items in the development of bearings for rolling mill equipment has been the development of the bearing steel and the heat treatment. After extensive tests both in the laboratory and on roll necks of mills, a special heavy duty roller bearing steel has been developed to stand the terrific strains set up in rolling mill practice.

By H. A. WINNE
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

The sheet and tin section of the industry seems to be going through the throes of a violent awakening, and has shown much activity, evidenced by the installation of automatic furnace and catcher equipments, cold strip mills, Steckel mills, continuous gauging equipment, automatic length measuring apparatus, bright annealing furnaces, and so forth.

By A. W. ROBERTSON
Chairman, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

This depression has taught the world that we must stand together or perish and it is marvelous how well we are holding together considering the difficulties we are facing due to the amount of unemployment which still exists. Those who are caught in the economic distress are showing remarkable patience and fortitude. On the other hand those still employed are helping out more and more. As a result we are muddling through with a minimum of grief and suffering.

By GERARD SWOPE
President, General Electric Company, Schenectady, N. Y.

Possibly the best basis for trying to judge the immediate future is the recent tendencies of the past. For that purpose I know of no better index than the use of electricity throughout the United States. This index is the quickest reflection of business activity because when a manufacturer gets an order he starts a motor to run his machinery and turn out the order.

and in the household the increased use of light and appliances may be a reflection of a little more employment or, at all events, better psychology.

By JOHN A. OARTEL
Chief of Safety Bureau, Carnegie Steel Company, Pittsburgh, Pa.

So Safety, like many business concerns, enters the year 1933 standing on more solid ground. During its existence of more than twenty years in steel mills, it has proven its worth. It is standing on a firm foundation because it is constructive and appeals to the finer traits in humanity. It makes for the health, happiness and well-being of every man, woman and child.

By A. F. DAVIS
Vice President, The Lincoln Electric Company, Cleveland, Ohio.

It has been only a comparatively few years since Welding Departments were established in iron and steel plants. Such departments were organized by progressive executives to salvage apparatus and machinery which formerly were sent to the melting pot to be used as a part of the scrap going to make up the charge for the open hearth. It was soon found that the welding department was cheating the scrap pile, saving thousands of dollars by making repairs to equipment which would otherwise be scrapped. Further savings were made by the lower inventories of spare parts necessary.

By A. P. STECKEL
President, Cold Metal Process Company, Youngstown, Ohio.

Development of four-high roller bearing mills in the past few years and extensive use of them in sizes from the largest to the smallest, clearly indicates, for the immediate future, a very broad general application of the strip process to the production of all flat products, beginning with plates, and ending only with the very thinnest materials. Such new development means, of course, the abandonment of two-high and three-high hot mills in rolling the wide flat products and also, largely, the abandonment of two-high cold mills, not only in the wider sizes but even down to the very narrowest mills. These developments, in fact, mean nothing but a cure for the weaknesses that were always inherent in two-high mills when employed on wide flat products in hot rolling, and the much more pronounced weaknesses of the two-high mill when employed in cold rolling of all widths.

By F. MOHLER
Industrial Engineering Department, General Electric Company, Schenectady, N. Y.

The primary object of any rolling mill is to produce steel, but steel for a definite purpose, having definite physical properties. The machine must not only produce the desired product, but must have an output which (even under the present state of competition) will pay a reasonable return on the capital invested. Although these are questions primarily of mill design, the electrical equipment must be fashioned with them in mind.

By D. M. PETTY
Superintendent Service Division, Bethlehem Steel Company, Bethlehem, Pa.

In conclusion, it should be emphasized that for Industrial Plant shifting, there is a best type of unit for the various working conditions to be encountered and only a careful analysis will show which unit this is. There is no universal panacea for all the kinds of shifting work to be found in Industrial Plants.

By W. L. GARRISON
Asst. Mgr., Locomotive Dept., Ingersoll-Rand Company, New York, N. Y.

I agree thoroughly with Mr. Petty that there is no one locomotive that will handle all switching jobs and that you have to be very careful in the selection of your power, particularly today, to get the most economical results and to avoid a mis-application.

By R. K. MANGAN
Sales Mgr., Industrial Division, The Buda Company, Harvey, Ill.

Our company has manufactured gasoline engines for locomotive service for approximately fifteen years, and the Buda-M.A.N. Diesel engines for about six years. We feel sure in the larger size locomotives, especially from 20 tons up, the gasoline engine is being obsoleted quite rapidly by the Diesel engine.

By R. J. O'BRIEN
Engineer, Transportation Dept., Westinghouse Electric & Mfg. Company, Philadelphia, Pa.

To get practically a comparison in maintenance costs and reliability of two such modern equipments, two United States railroads each bought an oil-electric car and a gas-electric car of approximately the same horsepower size, and in the fall of 1930 put them in service. In each case the oil-electric car and the gas-electric car were in identical service, running opposite to each other, i.e. on the same trains on alternate days. This gives a much better comparison of conditions than is possible with switching locomotive operation because of the variation of the duty cycle for any switching locomotive from day to day. One road continued the opposite running during the more than two and a quarter years, and on the other road the gas car was moved to any run some time last year.

Both the repair—maintenance cost and availabilities, for the last reports available as of some time last year, are favorable to the oil-electric car on both properties.

By O. J. GILCREEST
Engineer, Transportation Dept., General Electric Company, Schenectady, N. Y.

I want to emphasize these points on the combina tion engine battery, the gas-electric and the oil-electric type of locomotive—they are a real money maker due to their lower maintenance, higher availability, longer life, and in spite of the higher first cost as compared with steam locomotives.

The economics of these internal combustion locomotives, with or without battery, are that they will pay their first cost out of saving in a surprisingly

short time when replacing steam. This indicates a handsome return on the investment.

By G. J. WALZ
Asst. Elec. Engr. Bethlehem Steel Company, Steelton, Pa.

Our plant is far from being concentrated, its over-all length being about three and one-half miles, so that, in doing the shifting, there is probably more mileage to cover than there would be in many other steel plants.

Our Transportation Department has figures, which show that the gas-electric locomotive does about 20% more shifting work, that is, handles 20% more cars per engine service hour, than a steam locomotive actually has done and would do, under the same conditions. It is somewhat slower on the grades, but faster and snappier on the level, and since the plant only has a few grades, the net result is that it is able to do more work than a steam locomotive.

By L. F. COFFIN
Superintendent Mechanical Department, Bethlehem Steel Company, Sparrows Point, Md.

Composition bearings, consisting of a shell of the bearing material from ½" to 1¼" thick which is used as a facing on a cast steel bearing, are continually widening their field of application from the smallest high speed mills to the largest plate mills. Compressive strengths of from 30,000 to 40,000 lbs. per sq. in. are claimed for these materials. It is to be noted that the same general restrictions probably apply to their use as is the case with lignum vitae, as far as speed is concerned. Though this may be overcome, it would appear that this low limit may be in the neighborhood of 100 ft. per minute neck speed. The power consumption with composition bearings seems to be still lower than is the case with lignum vitae. In one case, on test, the rolling power input on one stand showed about ½ the power required with lignum vitae as against bronze and babbitt and about ¼ the power required with composition as against bronze and babbitt. While sufficient tests have not been run to state definitely that these figures will hold, indications are strong that power consumption is very much less. This is further evidenced by the highly polished mercury like surface which roll necks take after running on either lignum vitae or composition bearings.

In a finishing stand of a 21" Continuous Mill, Composition Bearings running at 468 feet per minute showed only 1/16" wear in the shell after 68,800 tons though the composition thrust collars were worn out and had to be renewed. There appears to be no reason why properly designed composition bearings in thrust should not show equally proportionate results over bronze and babbitt.

By W. H. BURR
Electrical and Mechanical Superintendent, Lukens Steel Company, Coatesville, Pa.

This plan of paying a workman for his ideas is one of the things which has resulted in building up the present relation between the employer and employees. It has helped the Management to come in closer contact with the workmen and the workmen to realize that the Management recognizes the ability of the individual employees. The idea is not a new one. For a time an erroneous impression prevailed among workmen the whole idea being considered by some as a huge joke.

By R. H. WRIGHT
Steel Mill Engineer, Westinghouse Electric & Mfg. Company, East Pittsburgh, Pa.

The applications for the simple synchronous tie, consisting of a transmitter and receiver, are very numerous. Perhaps the most familiar application is for remote indicators which will enable a single operator to observe the operation or check the adjustments of a number of devices at the same time. A continuous strip mill, for example, has a number of vertical and horizontal screwdowns. Except for minor adjustments to correct for mill variations, all screwdowns could be adjusted from the mill pulpit if suitable indicators were provided in the pulpit. The operators could then make speed adjustments quicker and more accurately. Another typical application of this type is the indicator for a shear or saw stop. In some cases an operator rides on the stop and checks adjustments by means of marks on the carriage or by a tape and indicator. A synchronous position indicator will make it possible to make such adjustments from a central control point. Two equipments of this type are in operation in a Chicago mill.

By P. R. HOLMES
Illuminating Engineer, General Electric Co., Philadelphia, Pa.

Recent years have shown considerable progress in the art of lighting. Notable improvements have been made in artificial illuminants and auxiliary equipments. General acceptance, however, has been slow, particularly in the reflecting equipments, as evidenced by the fact that 75% of industry today is challenged on the score of adequate and proper lighting. A very recent report from the Department of Labor states that accidents in United States industries attributable to faulty lighting, cost the service of 125,000 workers valued at $150,000,000 annually. Certainly this alone should be conclusive enough proof that there is still much to be accomplished.

By W. A. HAVEN
Vice President, Arthur G. McKee Company, Cleveland, Ohio.

Almost any combination of blowing and fanning periods can be worked out, either to meet the tonnage requirements or to accommodate periodic demands for hot metal. In almost every case, however, it would seem, on the basis of theory, that the best results would be obtained when the period of blowing is not longer than that required to empty the furnace of stock "predigested" by fanning; and in practice this procedure is generally followed. From 4 to 12 hr. blowing, alternating with periods of fanning of from 4 to 20 hr. duration, covers most of the cases with which the author is familiar.

In general, the lesser advantages from intermittent operation lead to the use of continuous slow blowing where the conditions are such as to make the method of reducing the production optional, and

this is in spite of the fact that during the fanning period a complete laying off of the operating force with the exception perhaps of one foreman or water tender, is generally followed. As with slow blowing, however, it may be stated with assurance that intermittent operation has been so successfully worked out in practice that it may be considered a permanent contribution to the art and one that will at times be utilized to advantage after the depression is behind us.

By C. J. SMITH
Electrical Engineer, Illinois Steel Company, S. Chicago, Ill.

When the construction of the Illinois Beam Mill was started in 1930 it was realized that no-one of the existing types of air conditioning equipments at South Works was desirable for the new mill. It was therefore decided to develop the idea of recirculating the motor room air. This scheme requires the use of surface type coolers in the path of the air, to remove the heat picked up from the machines. The amount of heat to be removed corresponds to the total losses in all machines, less the heat radiated by the walls and ceiling of the motor room. By employing a make-up fan of relatively small capacity, delivering air to the motor room through a reasonably good air filter, very little dirt is introduced into the room. Furthermore the make-up fan maintains a positive pressure in the motor room and all leakage is outward, preventing the infiltration of mill dirt.

By J. FARRINGTON
Electrical Supt., Wheeling Steel Corp., Steubenville, Ohio,
and
F. S. MILLER
Supt., Scale Dept., Wheeling Steel Corp., Steubenville, Ohio.

In the manufacture of sheets and tin plate the difficulty of rolling uniform gauges is common knowledge. As all sheets and tin plate are sold on base weights it is necessary to weigh the individual sheets either by the slow method of weighing each sheet on a scale by hand or by employing women to estimate the weight by picking up each sheet. The first method is too slow and costly and the second, while faster, is not as accurate as desired by the manufacturer. In order to obtain both speed and accuracy we have developed, manufactured and patented an automatic Sheet Sorting Machine for sorting tin plate sheets varying from 14" wide by 20" long to 30" wide by 40" long, in gauges ranging from 24 to 38.

By CHARLES M. SCHWAB
Chairman, Bethlehem Steel Corporation, New York, N. Y.

We have had three years of facing stern facts, and we can profit by continuing to be realistic. Let us see straight on our manufacturing set-up. If all the obsolete or semi-obsolete plant equipment were eliminated, that would go far toward strengthening our whole situation. I dare say, if it were possible to appraise fully the struggle to justify obsolete plants, we would find that much of the uneconomic disturbance in American manufacturing today is due to attempts to make "dead horses" pay. It takes courage to scrap a huge investment. We need not feel, however, that in so doing we are admitting a mistake in the past. We are in fact recognizing that conditions have changed and that we are reconstructing our set-up in line with modern demands.

Our steel picture is very materially changing. In the year just prior to and immediately following the war, the steel industry was manufacturing primarily for capital goods,—plants, huge buildings, and heavy-production equipment. This will always be a substantial back-log, but its dominance will be less marked. An increasingly important part of our business in the next few years will be in consumer's goods. The public for three years has been doing without thousands of items which enter into our normal standard of living. There is a three-year lag of automobile consumption to be made up. Progress in home-building has lagged for even a longer period. The use of steel in many directions has been arrested in its momentum by the hard times.

By S. R. COX, JR.
Hyatt Roller Bearing Company, Pittsburgh, Pa.

In the application of anti-friction bearings to various types of steel mill equipment, it is absolutely necessary that the intrusion of scale, water, dust, and other foreign matter be prevented. The deterioration of plain bearings is generally caused by abrasive action of foreign matter and consequent rapid wear of the bearing element and journals. With ordinary bearings, it is more difficult to properly enclose the bearing housing than is the case with anti-friction bearings.

By V. A. MENAGLIA
SKF Industries, Inc., Pittsburgh, Pa.

The question as to whether oil or grease should be utilized is one not easily settled. Generally, it can be stated that for steel mill equipment grease lubrication would be preferable, because of its sealing qualities. It has been our experience that if proper greases are selected, the lubrication schedules can be materially improved. As an example, of what has been accomplished along this line, we refer to you the experience the railroads are obtaining with traction motors. It must be admitted that railway motors are in many cases operated under dirty conditions comparable to those encountered in steel mill practice. In the past they had approximately 65 to 80% plain bearing replacements per year. Some of the newer equipment placed in service on the Pennsylvania Railroad and New York, New Haven and Hartford have, due to proper housing design and proper lubrication, operated over 100,000 miles without the addition of any extra grease. This mileage is assumed to be approximately a year of service.

It is our recommendation that instead of adding additional grease from time to time, the bearing housing be completely flushed out and clean new grease of the proper quality and quantity be added to the bearing housing. This is the practice followed by the railroads and which we would like to see employed in steel mill practice.

By E. C. GAINSBORG
Roller Bearing Company of America, Trenton, N. J.

Before giving any consideration as to the method of introducing the lubricant, it must be decided whether Grease or Oil should be used. While there is a general tendency to select grease, because it is believed that it can be better retained within the housing, the fact of the matter is that preference should be given to oil because it is possible to obtain a good grade of cylinder oil which is not compounded and consequently free from the fillers which are used in grease.

By H. F. BRENHOLTS
Fafnir Bearing Co., Pittsburgh, Pa.

We all know that standardization of equipment is the greatest factor tending to minimize investment in spares, but too frequently we sacrifice this standardization for reasons that are not economically sound by carrying duplicate stock where one would suffice.

By LLOYD JONES
Vice President, Continental Roll & Steel Foundry Co., Pittsburgh, Pa.

Let us for a few moments look into what the speaker termed "Properly Designed" construction. Many preconceived ideas will undergo radical changes and our designers will be called upon to exercise considerable ingenuity and study. The rolled products at hand are plates and various shapes, such as angles, channels, beams, etc. Most of these rolled shapes were especially designed for the construction of bridges, buildings, etc., for which they were admirably fitted. When it comes to using them in machine design, they are not so adaptable and the speaker believes certain sections should be modified or new ones developed. At least one concern is having special sections rolled. They are fortunate enough to require a sufficient tonnage to warrant the expenditure necessary in shape-rolls and guides. Other manufacturers cannot afford this of their own requirements. When bulked together, all of these manufacturers would use a considerable tonnage. Therefore, it might be pertinent at this time, for some engineering society to have a committee study this problem in conjunction with the producers of rolled steel products, thereby helping the designer, standardizing the required shapes and avoid costly mistakes.

By CHARLES F. ABBOTT
Executive Director, American Institute of Steel Construction, Inc.

The estimated potential market for the new uses of steel as so far developed and found to be practical would undoubtedly exceed 20,000,000 tons if these new markets were fully developed.

This represents a volume five times the present combined production of the steel construction industry.

We must not forget, however, that research, new uses, and new markets will fail completely unless the public are first acquainted with and educated to all of the advantages. Their acceptance must first be obtained before a demand can exist. Orders never happen, they must be stimulated by conviction, and this calls for intelligent advertising, promotion and aggressive salesmanship.

By C. E. BEDELL
Electrical Engineer, Mesta Machine Company, Homestead, Pa.

The remarks tonight seem to indicate that we have a big problem of co-operation between the mill builders, the builder of roller and ball bearings, the men who prepare the oil, and the men in the mills who take care of the bearings. I believe a method of co-operation among these agencies could be worked out with quite beneficial results to the general problem of anti-friction bearing applications.

By MARTIN J. CONWAY
Fuel Engineer, Lukens Steel Company, Coatesville, Pa.

Much economy has been effected recently by the better utilization of the steam locomotive and this has permitted extensive scrapping of types long obsolete and inefficient. The most striking development in the use of fuel on railroads has been the emergence of the oil engine or so-called Diesel locomotive from the experimental stage into the realm of practical railway politics.

The mere fuel economy of the oil engine as compared with the steam driven locomotive is well known, but the oil engine introduces entirely new conceptions into railroad operation and requires a new conception of means and procedure from the traffic department as well as from the mechanical and engineering departments.

That we can look for great changes and developments in this direction is certain. Liquidation of first cost of units is possible in five years with passenger train costs carrying 300 persons, as low as 20 cents per train mile.

The Diesel engine has, accepted high standards in marine work, using heavy residual oils as fuels and fitted with waste heat boilers, these units have a record of performance and ease of upkeep and handling which our merchant marine cannot afford long to ignore.

Large and medium sized generating units for industrial power uses are being considered for land use that have efficiencies of from 35 to 40 per cent delivered to the crankshaft.

Two developments which are giving the petroleum industry greater flexibility is the hydrogenation of oils from coal and the development of the compression ignition engine. We have a surplus of heavy residual oils which form the basis of such hydrogenation, and such as may be utilized in the Diesel type engine.

Furthermore, it is now definitely known that our liquid fuel resources are sufficient for at least two generations, and, through the combined efforts and research of the two fuel industries—solid and liquid, we can confidently look forward to a new era in the utilization of fuels.

By DON L. ORTON
Application Engineer, The Clark Controller Company, Cleveland, Ohio

Practically all industrial plants accumulate, over

a period of years, numerous resistor units and banks which very frequently represent the only salvageable part of a worn out or obsolete controller. Very often these resistors are charged to the Electrical Department as an inventory expense while they lie forgotten in some remote corner of the Electric Shop. The value of these units as spares to existing banks of similar make is undisputed but it is on new applications that the greatest opportunity exists to reduce this inventory expense.

▲ By E. A. HARPER
Chief Engineer, The Texas Co., Birmingham, Ala.

In order that we may best serve our industry, our country, ourselves, and foster low production costs, let us remember that we must first purchase intelligently, store and handle intelligently, apply safely and economically, avoiding all losses in handling and all excess handling charges, then only will we approach economical Lubrication. If we do so, we will have attained the much desired Lubrication and maintenance economy and at the same time will have taken a long step toward the preservation of personnel safety and certainly will have assisted in keeping our total production costs at an absolute minimum.

▲ By W. E. MILLER
President, Association of Iron and Steel Electrical Engineers.

We all realize that it is true of every function of business, government and even of the business of living itself, to progress we must have co-operation. The founders of our society recognized this fact twenty-seven years ago. These farsighted men visualized the problems which would confront the engineers of the iron and steel industry in the future. To these men we owe a debt of gratitude. We can help pay this debt by giving of ourselves as unstintedly as they, both our talent and service.

▲ By FEODORE F. FOSS
Assistant to Chairman & General Metallurgist, Wheeling Steel Corporation, Wheeling, W. Va.

Every steel producer, who wants to make **quality steel** consistently **at a lowest possible cost,** should have statistical supervision of all phases of his production and continuously improve the quality of steel and regulate the costs as results of such supervision.

▲ By GEORGE M. VERITY
Chairman, The American Rolling Mill Co., Middletown, Ohio

By education and training the competent engineer has the knowledge and ability which enables him to analyze figures and facts. He should now direct that ability more largely towards the problems of production and efficient management.

He should familiarize himself to a much greater extent with the details of operating practice so that he can more effectively contribute his part to the better utilization of raw materials and supplies, and to the better adaptation of existing facilities to the production of a product of superior quality at a minimum cost.

▲ By J. D. WRIGHT
Chief Engineer, Industrial Engineering Dept., General Electric Co., Schenectady, N. Y.

Today electricity is entering the service of our steel mills, on what promises to be a very large scale, in the comparatively new role of a source of heat for processing steel. Electrically heated furnaces provide a precision means of controlling temperature, rates of heating and cooling, and composition of furnace atmosphere which can be obtained in no other way. Quality and uniformity of product, elimination of costly handling, reduction of time in process, betterment of working conditions all contribute to make the electric furnace superior for many mill heating operations.

▲ By BENNETT CHAPPLE
Vice President, The American Rolling Mill Co., Middletown, Ohio

You have heard it said that the house of tomorrow will be largely welded steel homes with all the advantages of fire-safe construction. You have read many articles forecasting the prefabricated house as the economical answer to the high cost of shelter. There is evidence that these predictions are backed by a lot of sound reasoning. The American Rolling Mill Company as one of the largest manufacturers of iron and steel sheets has been much interested in the possibilities of this development. We have been glad to give encouragement and the benefit of our experience to engineers and builders working on the problem.

▲ By A. E. GIBSON
Vice President, The Wellman Engineering Co., Cleveland, Ohio

Twelve years ago the Wellman Company's first venture into welding was made as the result of an effort to find a way out of the difficulty which confronted them in the failure of cast steel gas producer top plates to withstand a high temperature on one side, water cooling on the other, and strains both from expansion and external sources. The venture was a success, and since that time an increasing amount of mechanical details have been changed from cast to welded contruction.

In many cases, increased strength of welded equipment was the principal reason for the change. In some, it was lighter construction. In many others cases, the change was made solely from the commercial standpoint of securing a less expensive product. In no case has service been sacrificed for cheaper construction, and in many instances all the advantages of light weight, increased strength, decreased cost, and saving in time, have been obtained.

▲ By A. F. KENYON
General Engineer, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The equipment and process for the production of steel strip by cold rolling, have undergone continuous development during the half century in which cold rolling has been actively practiced. The

developments and improvements in mill equipment by the mill builders, and in rolling and treating processes by the mill operators, have been accompanied by important developments in the electrical drive equipment by the electrical manufacturers. The electrical developments are no less notable than those concerning the mechanical equipment and operating procedure, and the successful performance of modern cold roll strip mills, operating at delivery speeds up to 1200 F.P.M. and producing stock down to .006" thick, up to 72" wide, and in coils containing several thousand feet, depends to a considerable extent upon the special characteristics of the mill and reel motors, and the smooth functioning of the control equipment.

By AUSTIN KUHNS
Mechanical Engineer, Farrel-Birmingham Co., Inc., Buffalo, N. Y.

During the past decade the technique in manufacture of gears and reduction units has developed to the point where it is difficult to realize the accuracy and the precision with which the different pieces are machined. This continued improvement will go on, but more noticeable in the next few years will be the improvement in the materials which will be used. In fact, there is available today for the designing engineer a host of specialties in the irons and steels and, in addition, there has been introduced the effective use of steel plate and rolled sections, and the heat treatment of those parts where special characteristics are desired.

By R. J. WEAN
President, Wean Engineering Company, Warren, Ohio

During the early stages and introduction of Continuous Furnaces in the Sheet and Tin Mills, the general furnace situation was beclouded with many irrelevant statements and prejudiced opinions. Importance was attached to types of fuel that later developments proved entirely unfounded.

Continuous Furnace development started with the firing of raw producer gas, progressed through the stages of washed producer gas, natural gas, coke oven gas, light oil, back to raw producer gas and now to the use of heavy oil. All of these fuels are being used in the production of various grades of material with satisfactory results.

The Sheet and Tin Mill that wishes to give consideration to furnaces should survey the available fuels and space for the installations. If there is some question as to the availability of a single fuel on a price basis that would be favorable, it would be advisable to consider equipping the furnace with a dual fuel system, i.e., oil and natural gas. This can be done with little extra expense and places the producer in the very favorable position of being able to shift to the lower cost fuel at any time.

By D. C. WRIGHT
Chief Engineer, The Electric Controller & Mfg. Company, Cleveland, Ohio

Why do mill engineers and metallurgists devote so much time to study of the proper amount of draft for each size of ingot or billet rolled in the Blooming Mill?

Are these drafts, or the rolling specification, accurately followed by the screw-down operator, when, in most cases, the whole responsibility is left up to his intelligence, strength and skill?

Improper drafts, especially on the first few passes, damage the quality of the steel or cause seams and cracks that require chipping before final rolling. Chipping is practically needless if the ingot is rolled to the specifications given by the metallurgist.

To insure that these specifications are adhered to, the "personal element" of the operator must be eliminated.

By E. A. HURME
Engineer, Clark Controller Company, Cleveland, Ohio

Of all the processes, developments and improvements that have affected the Steel Industry during its long history, one of the relatively recent ones is possibly as fundamental in its nature, as revolutionary in its effect and as far reaching in its results as any on record; namely, the process of electric arc welding. When we remember that only twelve or fifteen years ago it was little more than an artisan's process for repairing broken machinery and other metal parts and that today, it is a basic industrial factor in the production of automobiles, heavy machinery, steam boilers, pipes, tubes and general steel commodities, we begin to get a better understanding of its tremendous importance to the Steel Industry.

So much has already been said about arc welding, so many fantastic claims have been made for it that many individuals are today skeptical, if not openly scornful about the supposed advantages of arc welding. Therefore, it seems worthwhile that we make a more critical and more technical investigation of the subject with a view to understanding what actual progress has been made in arc welding, what really can be done with it and what its probable future is.

By WILLIAM C. BUELL, JR.
Engineer, Cleveland, Ohio.

With 45% hot metal and low carbon basic practice about 800,000 B.t.u. of heat must be added to the bath for each ton of steel produced.

As more than five and often six or seven times the amount of this heat must be supplied as primary fuel in order to accomplish this result, any factors which might tend to increase the rate of heat transfer to the bath are worthy of the closest investigation.

The most useful index of the comparative production rates of open hearth furnaces is found in the term "square feet of hearth necessary to produce one ton of steel in one hour."

By E. G. GRACE
President, Bethlehem Steel Corp., Bethlehem, Pa.

No outside agency could possibly take the place of our Employees' Representation Plan, without destroying that all-essential direct contact and relationship so necessary to insure to employees the best possible working and living conditions, and to management the co-operation of an intelligently informed body of employees. Under the Plan the employees have been kept constantly advised, through

their elected representatives, of the conditions of our business; and the part they have played in counselling and originating constructive labor policies is an attainment of which every employee can well be proud.

By F. M. GILLIES
Assistant General Superintendent, Indiana Harbor Mill, Inland Steel Co., Indiana Harbor, Indiana

Advertising has accomplished so many great things in our industrial and mercantile world, and has proven its worth so positively, that not to exhaust its possibilities and to thoroughly infuse it into any program which is difficult to promote, is a serious mistake. The type of advertising most familiar to us is the sign of the poster, but this can be definitely overdone. One sign placed at a strategic point, or where it would be generally observed, is worth a hundred cluttering up a wall or a mill entrance. We only have to relate our impressions in regard to advertising observed on the main motor highways, to conclude that no one advertiser stands out, and although we know that there are any number of Inns, Taverns and Barbecues five hundred yards farther on, it is seldom that anyone of them is convincing enough to draw our trade. Therefore, the conclusion must be that the signboard method should be used discriminately, and the advertising derived to gain our point must come from the sign itself. Here we may attract the eye and clinch the memory by unusual color combinations, unusual wording, or unusual shape. The obvious is rarely interesting, and therefore to attract and to hold the attention all signboard methods of safety advertising should be somewhat out of the ordinary.

Electrical Developments In The Steel Industry In 1933

By R. H. WRIGHT
Steel Mill Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Automatic screwdown equipment for a three-high sheet mill consists of a limit switch mounted on a pedestal located near the mill stand. This pedestal also carries the pushbuttons and master switches for complete control of the tables, furnace and other mill auxiliaries whether operated automatically or by hand. The automatic screwdown control is a combination preset and follow-up device. A set of hand levers on the limit switch enables the operator to set up the mill for any predetermined schedule. Schedules can be changed in a few seconds between packs or while rolling. More or less than the scheduled number of passes can be made if desired to give special treatment to individual packs. The control is usually arranged so that the roller controls the timing of the various operations by means of pushbuttons. One button starts the screwdown another the tables and so on. The various motions are stopped automatically at the proper position. However, two three-high mills have been provided with full automatic control to roll automatically without close attention of an operator.

Typical of the tendency to use automatic equipment is a flying shear installed during the past year. This flying shear is used to cut merchant bar to hot bed lengths. In addition to cutting the bar at any delivery speed between 700 and 2000 FPM. the flying shear control also operates the hot bed gates so as to make proper disposition of the finished material. Successive lengths are sent down opposite sides of the hot bed. If, after making a number of full length cuts, a piece remains which is shorter than the scheduled length, the shear is locked out and no cut is made. This avoids making a cut on the front end of the next bar. If the last piece from a billet is longer than scheduled length by a certain amount, a cut is made and the full length bar is sent down one side of the hot bed and the short length is sent down the other side of the hot bed. If the last piece is only slightly longer than the scheduled length no cut is made and the entire piece is sent down the proper side of the hot bed.

Another device which promises to become popular in merchant mills is the precision mill. Such a mill is being constructed to meet the demand for hot rolled round stock with about the same variations in size and shape as are now obtained only with cold drawn material. The mill has a single stand and will be located directly in front of the last stand of the main mill. The electric drive is of novel design and will be synchronized with the main mill. The performance of this mill will be watched with considerable interest.

By H. A. WINNE
Industrial Engineering Dept., General Electric Company, Schenectady, N. Y.

The Steel Industry has purchased a considerably greater amount of electrical equipment in 1933 than it did last year, as was to be expected because of the greater activity in steel manufacture. There have been several interesting electrical developments which have helped to improve the quality and lower the cost of manufacturing various steel products.

Cold Strip Mill Drives

The activity in sheet and tin mill developments which has been so evident for the past year or two has continued in 1933. The trend toward the production of tin plate and sheets by the cold strip rolling process seems to be gathering momentum. Several tandem cold strip mills, a large Steckel mill, and a number of cold strip mills with driven rolls and reels have been or are being installed.

One of the most recent tandem mills, which it is understood will be used for rolling tin plate, has five stands in tandem with a tension reel. This seems

to be rather a radical shift from the tendency to decrease the number of stands in tandem which has been apparent for the past two years. Several years ago it was common to have four stands in tandem for cold strip rolling. Within the past two or three years many mills having only two or three stands in tandem have been installed.

This year, in addition to the 5-stand mill mentioned, a 4-stand mill has also been purchased. The 5-stand mill is very heavily powered, the first and last stands each being driven by a 500 hp.—400/800 rpm. motor, and the three middle stands each having a 750 hp.—400/800 rpm. motor. The tension reel has a 150 hp.—225/900 rpm. drive. Power for this mill is supplied by an individual 2500 kw. motor-generator set, and the adjustable voltage method of starting, stopping and speed control is used. This adjustable voltage method of control has been consistently advocated by the General Electric Company for mills rolling wide thin strip, and is now employed on almost all new tandem mills.

The single stand reversing cold strip mill with driven rolls and a tension reel on each side of the mill has introduced new problems in regulation and control which have been solved successfully. In mills of this type it is essential that during the rolling of any one pass the tension on the strip between each reel and the rolls be maintained accurately at a constant value. This applies not only to the forward or pulling reel, but also to the unwinding or back tension reel. As each reel is driven by an individual motor, it is comparatively simple to accomplish this when the mill is running at constant speed, by utilizing a vibrating type of regulator which controls the reel motor field in such a way as to maintain constant current input to the armature. Obviously, with constant armature current and voltage, constant tension is maintained so long as the strip speed is constant.

However, this same tension must be maintained while accelerating from rest to running speed and while decelerating, and this is by no means simple to accomplish. The inertia of the reels and reel motors is considerable, and if the current input during acceleration were maintained at the same value as while running at constant speed the tension would not be correct. On the pulling reel a certain amount of the current would be needed to accelerate the reel and motor, thus leaving an insufficient amount to maintain the desired tension. On the back tension reel, where the motor acts as a generator while running at constant speed, if the same current output were held while accelerating, the tension would be too great because of the additional pull required to accelerate the motor and reel.

Consequently, while the speed is being adjusted, it is necessary to automatically alter the setting of the current regulator in accordance with the rate of acceleration or deceleration of the mill. This is accomplished by utilizing the current input to a very small d-c. motor driving a small flywheel to bias the setting of the tension regulator. The armature of the flywheel motor is connected in parallel with the armature of the reel motor so that it is forced to accelerate at the same rate as the reel. Therefore, if the mill is accelerating at a high rate, the flywheel motor will draw a comparatively heavy current through the biasing coil on the regulator, causing it to hold a larger input to the leading motor and a smaller output from the trailing motor, thus maintaining constant tension in the strip. The system works equally well in deceleration.

An individual motor-generator set is utilized to supply power to each reversing strip mill drive, permitting the use of adjustable voltage control which is absolutely essential. The main mill motor usually has a 2 or 3:1 range in speed by motor field control, in addition to the adjustment by armature voltage. The reel motors must operate over a much greater range, due not only to the change in diameter of the coil as it builds up, but also to compensate for the difference in speed of the metal on the entering and delivery sides of the mill. With drafts running as high as 40% or 50%, this is no small item, and to compensate for the difference in speed due to draft an auxiliary bucking generator is connected in series with the armature of the trailing reel motor, to reduce the voltage from the main generator in proportion to the draft.

The control and regulating systems for these reversing mills have been perfected to a very high degree and the tension is maintained very accurately at all times. When it is realized that in one of these mills the range in thickness of the cold strip is from ¼" to .01" the necessity for easy adjustment and accurate control of tension may be realized. As indicative of the size of the equipment involved on the reversing mills, one mill for which the General Electric Company has recently furnished the equipment has a 1000 hp.—200/400 rpm. motor on the main rolls, and a 500 hp.—400/960 rpm. motor on each reel. Another has a 1500 hp.—100/300 rpm. main roll motor, and two 800 hp.—250/750 rpm. reel motors. A third has a 1500 hp.—200/400 rpm. main motor, and two 700 hp.—150/525 rpm. reel motors. Each is equipped with a suitable motor generator.

One of the reversing cold strip mills is equipped with a pre-set automatic screwdown control. This equipment utilizes a combination of Selsyn transmitters and thyratron tubes in conjunction with the usual magnetic panel. While one pass is being rolled, the operator, by turning the handwheel, sets the pointer at the place on the dial corresponding to the thickness of metal he desires for the next pass. Then when the first pass is finished he simply throws the handle of a control switch and the motors driving the screws automatically bring the rolls to the setting corresponding to the indication on the control desk. The indicator on the desk has both a coarse and vernier scale so that it is possible to adjust it very accurately.

Several cold strip mills have been equipped with continuous gages for indicating the thickness of the strip leaving the mill. On one of the reversing mills the continuous gage is equipped with contacts for controlling the screwdown to maintain automatically the thickness of the metal leaving the mill within the tolerances for which the contacts are adjusted.

Another recent contribution toward the production of more uniform strip is an instrument to give a continuous indication of the percentage reduction being made in a reversing strip mill. It is obvious that the ratio of the speed of the strip leaving the mill to the entering speed will vary with the percentage reduction in thickness made in the mill. That

is, if the delivery speed is 50% faster than the entering speed, the reduction or draft is 50%. This fact is made use of in the "percent draft" indicator. The strip on each side of the mill rides over a roller whose speed is, therefore, in proportion to the strip speed. To each of these rollers is coupled a small generator. These generators are excited from the same source and their armatures are connected to two different windings of a special meter which indicates the ratio between the voltages of the two machines. This meter is calibrated in percent draft and gives the operator a continuous indication of the reduction being made in the strip passing through the mill. The use of this indicator not only permits the rolling of more uniform strip, but also saves time which would otherwise be required to micrometer the strip by hand.

New Year's Statement

By A. W. ROBERTSON,
Chairman, Westinghouse Electric & Manufacturing Company

The United States Government is spending three billion, three hundred million dollars on public works. In 1932 the American people, at the bottom of the depression, spent approximately four hundred billion dollars in the buying of goods and services. These figures are startling. Even taking into account the various processes of turnover taken by our public works dollars as they multiply themselves, appearing and reappearing in pay rolls in the purchase of materials, in consumer purchases, in retailer purchases, in wholesaler purchases, etc., etc., still this public works program of the United States Government amounts to only a small fraction of what Mr. Public Citizen spent in one year of depression.

If we study these figures for a moment we see how much more important individual and corporate spending is than Governmental spending. A 10% increase in what the consumer, corporate and individual, spends would amount to forty billions of dollars, or more than ten times the amount the Government is spending on public works. A comparison of this nature shows definitely that the normal exchange of goods and services by persons and corporations is the base upon which business and business recovery must rest. Government cannot by spending or by law create good business. It can feed us and clothe us, perhaps, for a time but it cannot legislate prosperity.

Practically all spending is for future needs. We buy clothes to wear tomorrow. If we knew we were going to die tomorrow we would not buy the clothes, or at least we would buy only one suit. We build houses to live in tomorrow. We build ships to sail in tomorrow. The buying and selling of goods and services is stimulated or retarded by persons and corporations directly as they have confidence in the future. Unless tomorrow has a pleasing and definite outline we put off buying until we see its outline more clearly.

Now that NRA, AAA, CWA, etc., are swinging into action, the future is beginning to take a more reassuring form than it had a few months ago. In other words, we are getting used to the present, so that our tomorrow begins to take on the form of something we understand and for which we can plan. As this concept becomes more definite in our minds, and we gain confidence in this tomorrow, our buying of goods and services will increase, which means the end of the depression and better times for everyone.

As far as the electrical industry is concerned, it faces the new order confidently. Its resources have been conserved, its technical progress has been uninterrupted, research has discovered many new uses for electricity, and new devices have been developed for its utilization.

As the heavy machinery market sagged more attention was given to the development and distribution of devices for the home. Business resulting from this stimulation of the household market has been of great aid in keeping the electrical industry intact and there is a fair assumption that it will continue.

When capital goods business finally yields to the many forces now being exerted for its improvement, the electrical industry cannot fail to benefit and again resume its rightful place as one of our most essential and most prosperous industries.

Review and Outlook For The Iron and Steel Industry

By WALTER S. TOWER
Executive Secretary, American Iron & Steel Institute

The iron and steel industry is looking to 1934 with the feeling that the lowest point of the depression has been passed, and that the coming months should bring a measure of improvement in consumption and output of steel products. This feeling is based chiefly upon signs of expanding demand, together with a stabilized price structure and more favorable marketing conditions ushered in by the Code.

The Steel Code was designed to increase employment and to eliminate unfair competition and under it these ends are being accomplished. The requirement that price changes be listed in advance with the American Iron & Steel Institute, the Board of Directors of which constitutes the Code authority,

has brought a new competitive era into the steel trade.

For the first time in many years the art of true salesmanship is becoming a factor in selling steel. During recent years, steel has been sold in too many cases on secret concessions in price, credit, or terms. Now that these unfair competitive weapons are eliminated, the emphasis in selling has been placed where it should be, namely, on quality, service to consumer, delivery convenience and similar points. All this makes for a healthy condition of competition which is no less keen and aggressive than formerly.

Under the Code, a fair measure of price stability is likely to prevail because of the open price provisions. Reasonable stability is in the interest of consumers as well as of producers of steel.

Large increases in costs have been assumed by the steel industry, in compliance with the Steel Code, and all of which have only in part been countered by moderate advances in steel prices. However, the decline which had been under way in steel prices more or less continuously since 1926, and which in many products reached ruinous figures materially below producing cost, appears to have been checked.

Average operations in the steel industry in 1933 were conducted at a rate approximately 32 per cent of capacity, which compares with a rate of about 20 per cent in the previous year. There was considerable fluctuation in the rate during the year, ranging from the low point of 13 per cent of capacity, the second week of March, to a high point of 58 per cent in July. There followed a decline to 25 per cent of capacity in November but early in December a fresh rise in operations began. Output of steel ingots in 1933 approximated 23,000,000 tons compared with 13,400,000 tons in 1932, an increase of 73 per cent.

The four most important consumer lines of steel are automobiles, building construction, containers and railroads. In 1932 they are estimated to have taken 55 per cent of all the rolled steel consumed. Containers, reflecting demand chiefly from the food, oil and packing industry, in 1932 took more steel than the railroads, and this probably remained true in 1933. Oil, gas and water production comprise another important group of consumers.

Automobile production, in 1933, approximated 2,000,000 cars and trucks. There are many predictions that this will be increased by 25 to 30 per cent in 1934. Definite improvement has taken place in the petroleum industry, and some gain in buying from that quarter is expected. Building construction should show some expansion, largely as a result of public works activity. It is expected that further purchases of railroad material and equipment will materialize.

On the whole, it may be said that there is more hope in the outlook for the lighter steel lines than for the heavy products, and this may be expected to prevail until the flow of funds into capital investment is resumed. Offsetting, in some degree, the inadequate movement of private funds into channels of investment will be government advances in connection with public works and other phases of the recovery program.

One of the most important developments in the steel industry, under the Steel Code, during the past year has been in the field of labor and employment. According to figures reported to the American Iron & Steel Institute, it is shown that employment in the industry at the beginning of November had reached a total of 416,000, compared with 338,000 in June, and 210,000 estimated for 1932.

This means that the number of men on the pay rolls in the country's steel plants is now practically as great as it was in the boom years of 1929 when operations were at the rate of more than 85 per cent of capacity. It is estimated that if operations of steel plants rise to 70 per cent of capacity, it will be necessary to add at least 125,000 to the pay rolls. The eight hour day now generally prevails in the industry, and average earnings per hour for employees have increased 22.4 per cent since June.

The steel industry is giving full co-operation to the National Recovery Administration in an effort to improve employment as was fully set forth in its report to the NRA and its request for extending the life of the Steel Code. Throughout the industry the principle of collective bargaining is in effect through employee representation plans, some of which have been functioning successfully for many years. Labor conditions in the industry have been outstandingly free from strife.

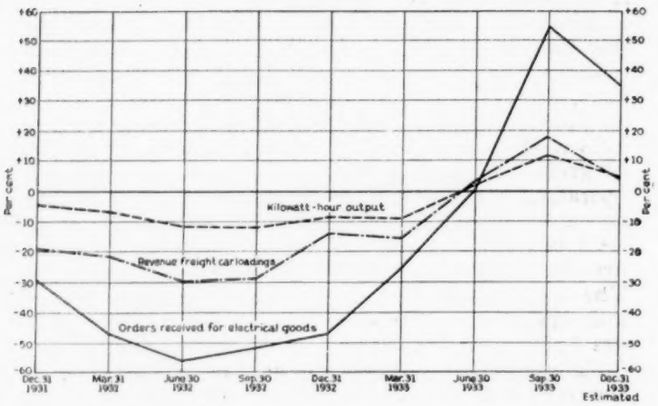
As indicated by quarterly reports, the year resulted in losses for the majority of steel companies but not as heavy as in 1932. Investment in the steel industry approximates $5,000,000,000, and there are estimated to be more than 500,000 stockholders. The iron and steel industry has recognized that its first obligation is to its employees, and work and a decent living for as many people as can possibly be kept on the pay rolls are accepted principles in the industry. At the same time, executives are conscious of their obligations to stockholders, and are looking forward to the time when the industry may be restored to a profitable basis which will not only give labor its fair share, but will also allow for a fair return to stockholders.

The Outlook For 1934

By GERARD SWOPE,
President, General Electric Company

These are difficult times to prognosticate and possibly it is human to turn to past prophesies, especially when they have turned out fairly well. Last year I stated that the indices of use of power and revenue carloadings showed a continued upward trend and that therefore we were hopeful that this upward trend would continue. I am showing here on the following page, the same indices continued through 1933 and it will be seen that for the quarter ended June 30, 1933, the three crossed the line and have been distinctly upward since. The fourth quarter has gone down from the high point but is still better than for the same period in 1932.

Now with codes of fair competition adopted in many of the industries, with the increased employ-



Per Cent Change Each Quarter from Same Quarter Previous Year.

ment and increased purchasing power that has been brought about, these activities naturally and undoubtedly will cause some increase in prices to the ultimate consumer.

The problem of today is to have a greater revival in the capital goods industry, which has felt the increase but little, and with all the experiments that are being made and the hopeful and constructive attitude being shown, we are looking forward with confidence that 1934 will be a better year than 1933 in employment and in industry.

Anti-Friction Bearings As Applied To Hot and Cold Strip Mills

By F. C. HALLMARK
General Master Mechanic, Wheeling Steel Corporation, Steubenville, Ohio

▲ Presented before the Electrical and Mechanical Divisions of the A. I. & S. E. E. at the Twenty-ninth Convention in Pittsburgh, Pa., October 18, 1933.

The first great care in applying anti-friction bearings to strip mill practice is, naturally, design. A great deal of time and money has been spent during the last few years by mill and bearing designers in developing bearings capable of meeting the increased loads and speeds of present day engineering requirements.

Numerous improvements have been made during this period in alloy steel analyses, heat treating practices and slight modifications in design. However, the basic principles of the bearings have not been improved upon, having fulfilled most expectations as to bearing efficiency under higher speeds as well as increased loads.

The safe load capacity of any anti-friction bearing varies with operating conditions. Conditions, such as mountings involving the support of the bearings without distortion or misalignment, proper adjustment and lubrication, exclusion of abrasives and moisture, all have a very important influence on bearing service.

The life of an anti-friction bearing is normally limited by "fatigue", or failure of the load carrying surfaces. All other types of failure are premature and can be avoided by correct design, proper shop practice or suitable maintenance facilities.

Fatigue of metals is a recognized type of failure which is characteristic of repeated stress conditions. In an anti-friction bearing it is due to minute progressive cracks in the load carrying surfaces. Further development of this condition leads to spalling of the surface. The early appearance of spalling is usually evidence of overload.

F. C. HALLMARK

A great deal of trouble has been experienced in cold strip mill bearings due to fatigue failures—in some cases designed for load capacities that were too low, however, in most cases we believe these failures were brought about by the desire of operators to roll heavier and wider materials or increase tonnage by heavier drafts.

Premature failure may be caused by excessive wear or excessive heat due to the entrance of abrasive matter into the bearing, also a great many failures are due to corrosion, sometimes called "water etch", due to its appearance. These failures naturally happen more often in hot strip operations, due to scale from the strip and the great amount of water used for cooling the rolls and descaling. Eliminating these failures is naturally a matter of design if they occur due to entrance of foreign matter during operation. Water tight seal rings will serve to correct most of them, however, if proper handling facilities are not provided there is danger of getting abrasive matter in the bearings while making periodic inspections. A separate room with wash tanks should be provided where the inspections can be made and at the same time keep the bearings free from all mill dirt.

No set rule can be made for the frequency that inspections should be made as operating conditions would determine this, however, inspections should be made at intervals and a record kept of the exact condition of each bearing in order that the maintenance man can follow the life of the bearings individually and determine when repairs or replacements are needed.

MAIN ROLL DRIVES OVER 300 H.P. INSTALLED IN STEEL MILLS DURING 1933

No.	H.P.	Speed	Voltage	Freq.	Type of Mill	Method of Drive	Purchaser	Plant Location	Mfgd. By
1	300	400–800	230	DC	Hazelett Mill	Geared	International Nickel Co.	Huntington, W. Va.	A.C.
2	400	200–800	600	DC	12″ Hot Strip Mill	Geared	American Steel & Wire Co.	Cleveland, Ohio	G.E.
3	400	200–800	600	DC	12″ Hot Strip Mill	Geared	American Steel & Wire Co.	Cleveland, Ohio	G.E.
4	400	250–750	250	DC	4-High Cold Mill	Geared	Eastern Rolling Mill Co.	Baltimore, Md.	G.E.
5	*400	300	440	60	Cold Mill	Geared	American Steel & Wire Co.	Cleveland, Ohio	G.E.
6	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
7	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
8	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
9	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
10	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
11	400	980–1500	375	DC	Foren Tube Mill	Geared	Globe Steel Tubes Co.	Milwaukee, Wis.	A.C.
12	500	300/600	600	DC	Merchant Mill	Geared	Missouri Rolling Mill Co.	St. Louis, Mo.	W.
13	500	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
14	500	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
15	500	300/900	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
16	500	300/900	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
17	†500	443	4600	60	18″ Billet Mill	Geared	Rotary Electric Steel Co.	Detroit, Mich.	W.
18	600	250/815	600	DC	Cold Strip Mill	Geared	Youngstown Sheet & Tube Co.	Indiana Harbor, Ind.	W.
19	600	250/875	600	DC	Cold Strip Mill	Geared	Youngstown Sheet & Tube Co.	Indiana Harbor, Ind.	W.
20	600	300/900	250	DC	Cold Strip Mill	Geared	Weirton Steel Co.	Weirton, W. Va.	W.
21	600	300/900	250	DC	Cold Strip Mill	Geared	Weirton Steel Co.	Weirton, W. Va.	W.
22	600	300/900	250	DC	Cold Strip Mill	Geared	Weirton Steel Co.	Weirton, W. Va.	W.
23	600	300/900	250	DC	Cold Strip Mill	Geared	Weirton Steel Co.	Weirton, W. Va.	W.
24	700	150/525	600	DC	Rev. Cold Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	G.E.
25	700	150/525	600	DC	Rev. Cold Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	G.E.
26	700	150/525	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
27	700	150/525	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
28	750	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
29	750	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
30	750	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
31	750	400/800	600	DC	Tandem Cold Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	G.E.
32	800	250/750	600	DC	Rev. Cold Mill	Geared	Jones & Laughlin Steel Corp.	Aliquippa, Pa.	G.E.
33	800	250/750	600	DC	Rev. Cold Mill	Geared	Jones & Laughlin Steel Corp.	Aliquippa, Pa.	G.E.
34	800	300/600	250	DC	12″ Bar Mill	Geared	Rotary Electric Steel Co.	Detroit, Mich.	W.
35	1000	200/400	250	DC	Rev. Cold Mill	Direct	Republic Steel Corp.	Warren, Ohio	G.E.
36	1000	400/800	600	DC	Steckel Cold Strip Mill	Geared	Inland Steel Co.	Indiana Harbor, Ind.	W.
37	1200	500/800	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
38	†1250	885	2200	60	Merchant Mill	Rope	Sheffield Steel Corp.	Kansas City, Mo.	W.
39	1500	100/300	600	DC	Rev. Cold Mill	Direct	Jones & Laughlin Steel Corp.	Aliquippa, Pa.	G.E.
40	1500	200/400	600	DC	Cold Strip Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	W.
41	1500	200/400	600	DC	Rev. Cold Mill	Geared	American Sheet & Tin Plate Co.	Gary, Ind.	G.E.
42	†1500	360	11000	60	18″ Billet Mill	Geared	American Steel & Wire Co.	Cleveland, Ohio	W.
43	*4500	514	11000	60	Continuous Rod Mill	Geared	American Steel & Wire Co.	Cleveland, Ohio	G.E.

* Synchronous Motor. † Wound Rotor Motor.

MAIN ROLL DRIVE STATISTICS

MAIN DRIVE MOTORS SOLD 1933

ALL MOTORS 300 H.P. OR OVER

Companies	Total H.P. Purchased 1933
American Sheet & Tin Plate Company	8000
American Steel & Wire Company	7200
Eastern Rolling Mill Company	400
Globe Steel Tubes Company	2400
Inland Steel Company	5000
International Nickel Company	300
Jones & Laughlin Steel Corporation	3100
Missouri Rolling Mill Company	500
Republic Steel Corporation	1000
Rotary Electric Steel Company	1300
Sheffield Steel Corporation	1250
Weirton Steel Company	2400
Youngstown Sheet & Tube Company	1200
Total	34050

Total Motors Purchased In Iron & Steel Industry	H.P. Per Motor
1	300
10	400
6	500
6	600
4	700
4	750
3	800
2	1000
1	1200
1	1250
4	1500
1	4500
43	

VOLTAGES USED ON MAIN ROLL DRIVE MOTORS

No. Motors Purchased	Voltage
1	230 D.C.
7	250 D.C.
6	375 D.C.
24	600 D.C.
1	440 A.C.
1	2200 A.C.
1	4600 A.C.
2	11000 A.C.
43	

TYPES OF MILLS* PURCHASED IN 1933

No.	Type
1	Hazelett Mill Drive
2	Hot Strip Mill Drives
1	4-High Cold Mill Drive
1	Cold Mill Drive
6	Foren Tube Mill Drives
2	Merchant Mill Drives
6	Tandem Cold Mill Drives
12	Cold Strip Mill Drives
2	Billet Mill Drives
7	Rev. Cold Mill Drives
1	Bar Mill Drive
1	Steckel Cold Strip Mill Drive
1	Continuous Rod Mill Drive

* Mills requiring 300 H.P. or over.

COMPILATION

43 Main Drive Motors over 300 H.P. purchased in 1933
38 Main Drive Motors over 300 H.P. used D.C. Current (25900 H.P.)
5 Main Drive Motors over 300 H.P. used A.C. Current (8150 H.P.)

ELECTRICALLY OPERATED CRANE STATISTICS, 1928-1933

ELECTRIC OVERHEAD TRAVELING CRANES, CHARGERS, HOISTS, PURCHASED BY IRON AND STEEL INDUSTRY

Table No. 1
Trend of Bearing Construction

Number of Cranes Purchased	Crane Tonnage	Completely Equipped with Anti-friction Bearings	Partially Equipped	Sleeve Bronze Bearings Etc.	Unclassified
1	½	.....	.....	1	.....
7	1	2	1	1	3
11	2	8	1	2	.....
5	2½	3	2	.....	.....
23	3	12	1	10	.....
6	3½	5	.....	1	.....
2	4	2	.....	.....	.....
140	5	54	24	62	.....
5	6	.....	.....	5	.....
46	7½	26	5	15	.....
4	8	3	.....	1	.....
288	10	154	54	79	1
1	11	.....	.....	1	.....
1	11½	1	.....	.....	.....
3	12	.....	.....	3	.....
1	12½	1	.....	.....	.....
1	13	1	.....	.....	.....
204	15	128	32	44	.....
69	20	43	10	16	.....
60	25	30	14	16	.....
22	30	11	4	7	.....
15	35	13	1	1	.....
32	40	22	1	9	.....
39	50	11	10	18	.....
2	55	1	.....	1	.....
17	60	4	6	7	.....
1	67½	.....	.....	1	.....
14	75	7	1	6	.....
1	80	.....	.....	1	.....
1	90	.....	.....	1	.....
20	100	2	13	5	.....
2	115	.....	.....	2	.....
10	125	5	4	1	.....
2	135	.....	2	.....	.....
22	150	7	6	9	.....
4	160	.....	3	1	.....
1	165	1	.....	.....	.....
11	175	3	4	4	.....
26	200	4	18	4	.....
2	220	2	.....	.....	.....
5	225	1	4	.....	.....
9	250	3	3	3	.....
3	275	.....	3	.....	.....
1	300	.....	1	.....	.....
1,140		570	228	338	4

Table No. 2

Type of Cranes Purchased	Total
Standard Cranes	534
Standard Cranes with Magnet and Bucket	5
Standard Cranes with Magnet	73
Standard Cranes with Sta. Hoist	13
Double Hook, Double Drum, Double Trolley	89
Standard Hook Cranes	16
Cupola Charger	1
High Type Charger	1
Floor Charger—Low Type	10
Open Hearth Chargers	20
Ladle Cranes	92
Soaking Pit Cranes	23
Soaking Pit—Low Type	5
Stripper	22
Tongs	7
Bucket	32
Gantry	13
Gantry—One Leg	1
Skull Cracker	1
Trailer Trolley	4
Pillar	3
Power House Cranes	4
Bloom Charger Cranes	2
Special Charger Crane	1
Pipe Charger Crane	1
Ingot Handling Crane	1
Quarry Hoist Crane	1
Trolley Cranes	5
Hot Metal Cranes	2
Ingot Mold Handling Crane	1
Crane Type Revolving Slab Charger	1
Mono Rail	9
Pit Crane	1
Wall Cranes	2
Spout Hoist Jib Cranes	3
Transfer Car	1
Foundry—Hot Metal	1
Copper Chargers	2
Special Crane	1
Coil Handling Crane	1
Unclassified	135
Total	1,140

Additional Trolleys and Bridges Purchased

13 Trolleys—	
Trolleys completely equipped with Anti-friction Bearings	6
Trolleys partially equipped with Anti-friction Bearings	4
Trolleys equipped with Plain Bearings	3
	13
2 Bridges—	
Bridge completely equipped with Anti-friction Bearings	1
Bridge equipped with Plain Bearings	1
	2

COMPILATION

Total Cranes Purchased, 1140.

Cranes completely equipped with anti-friction bearings	570
Cranes partially equipped with anti-friction bearings	228
Cranes equipped with sleeve-bronze bearings	338
Cranes unclassified as to bearings	4
	1140

Cranes equipped with Spur Gears	836
Cranes equipped with Worm Gear Reduction	75
Cranes equipped with Spur and Worm Gears	97
Cranes equipped with Spur and Herringbone Gears	85
Cranes equipped with Herringbone Gears	14
Cranes equipped with Worm, Spur, Herringbone and Spiral Gears	1
Cranes not classified as to Gearing	32
	1140

4444 Motors furnished. Total Crane Tonnage, 36,903½.

ELECTRICALLY OPERATED CRANE STATISTICS 1933

ELECTRIC OVERHEAD TRAVELING CRANES, CHARGERS, HOISTS, PURCHASED BY IRON AND STEEL INDUSTRY

Table No. 1
Trend of Bearing Construction

Number of Cranes Purchased	Crane Tonnage	Completely Equipped with Anti-friction Bearings	Partially Equipped	Sleeve Bronze Bearings Etc.	Unclassified
3	1	.....	.....	.....	3
2	2	1	1	.....	.....
4	5	1	3	.....	.....
2	7½	2	.....	.....	.....
11	10	9	2	.....	.....
7	15	5	2	.....	.....
1	20	1	.....	.....	.....
2	25	1	1	.....	.....
1	40	1	.....	.....	.....
1	50	1	.....	.....	.....
1	150	.....	1	.....	.....
1	200	.....	.....	1	.....
—	—	—	—	—	—
36		22	10	1	3

ADDITIONAL TROLLEYS AND BRIDGES PURCHASED
Table No. 1
Trend of Bearing Construction

1—10-ton Trolley	1	.....	.....	.....
1—10-ton Bridge	1	.....	.....	.....
1—15-ton Trolley	.....	.....	1	.....
2—20-ton Trolleys	1	1	.....	.....
1—35-ton Bridge	.....	.....	1	.....
—	—	—	—	—
6	3	1	2	

Table No. 2

Type of Cranes Purchased	Total
Standard Cranes	23
Standard Crane—3 Hook	1
Jib Cranes	2
Gantry	1
Ladle Crane	1
Inverted Ingot Stripper	1
Hot Metal Crane	1
Coil Handling Crane	1
Soaking Pit Crane	1
Special Crane	1
Unclassified	3
Total	36

COMPILATION

Total Cranes purchased	36
Cranes completely equipped with Anti-friction Bearings	22
Cranes partially equipped with Anti-friction Bearings	10
Cranes equipped with Sleeve, Bronze Bearings, etc.	1
Cranes unclassified as to Bearings	3
Total	36
Additional Trolleys and Bridges purchased	6
Trolleys completely equipped with Anti-friction Bearings	3
Trolley equipped with Sleeve, Bronze Bearings, etc.	1
Bridge completely equipped with Anti-friction Bearings	1
Bridge partially equipped with Anti-friction Bearings	1
Total	6
Cranes equipped with Spur Gears	17
Spur and Worm Gears	1
Spur and Herringbone Gears	12
Worm Gears	2
Worm, Spur, Herringbone and Spiral	1
Cranes not classified as to Gearing	3
Total	36

110 Motors furnished.
On 3 Cranes no motors used (Hand power).
Total Tonnage purchased, 767.
29 Cranes used D.C. Current.
4 Cranes used A.C. Current.

Welding Practices In the Iron, Steel And Allied Industries

Prepared by Welding Engineering Division of the A. I. & S. E. E.

Presented at the Twenty-ninth Convention of the A. I. & S. E. E. at Pittsburgh, October 19, 1933.

The art of Welding is one which is claiming attention throughout all industry, particularly the Iron and Steel Industry. Welding in the past in the steel industry has played an important part in maintenance work, however, in the last few years our industry has recognized the importance of all classes of welding for producing steel products.

G. A. HUGHES
Chairman, Welding Engineering Division of the A. I. & S. E. E.

Many of us wonder why our industry was slow to realize the advantages of welding, however, there is and will be the problems of metallurgy to meet before the industry will be able to take the full advantage of this class of apparatus for producing products of steel.

Our Society is particularly interested in the practical problems of welding, the selection, application, maintenance of welding equipment and naturally the steel products which may be obtained through the use of all classes of welding apparatus.

In order to indicate the status of welding in our industry we have prepared the following tabulation which data and information was secured through a questionnaire.

The ingot capacity of the Steel Industry of the United States is 71,000,000 tons annually. The capacity in tons of all companies replying to the questionnaire is 32,000,000 tons, or approximately 50% of the steel industry reporting.

We did not expect a 100% report. However, 50% reporting mades it a representative group.

There are many divisions of welding. Some are apparently little known among the men of the steel industry. This questionnaire does not create a question as to the merits of that branch of welding, but, on the contrary, it tells the up-to-date story that there is a fertile field for those salesmen of that particular branch of welding in acquainting the men of the industry with their product. This questionnaire has to do with welding practices only and not of products produced. This questionnaire shows a large field for welding devices and apparatus and it is estimated that the immediate potential field for welding machines in the Iron and Steel Industry is more than 3,000 machines.

QUESTIONNAIRE
Arc Welding Equipment

1. How many arc welder motor generator sets do you have?
   Answer. 2,016 reported.
2. How many single operator arc welding sets?
   Answer. 1,827 reported.
3. How many multiple operator arc welding sets (more than one operator welding from one machine?)
   Answer. 189. 91% are single operator.
4. What is the total welding current capacity (amperes) of these machines?
   Answer. Single 471,690—(233 Amp. Ave. per set.)
   Multiple 140,950—(750 Amp. Ave. per set.)
5. Are generators constant voltage or variable voltage? How many of each?
   Answer. 21% constant voltage.
   79% variable voltage.
6. Under what conditions to you favor single or multiple operator welding sets?
   Answer. 60% favor multiple operator welders for mass production.
   Single operator welders for maintenance
   5% favor single operator welders for both maintenance and production.
   25% are non-committal.
   10% local conditions govern. Little difference.
7. Do you favor constant voltage or variable voltage?
   {Constant energy
   }Constant current generator
   Answer. Opinions are equally divided.
8. Is your arc welding—
   {Production?
   }Maintenance?
   Answer. Production 40%.
   Maintenance 60%.
9. What trouble do you have with your electrode holders?
   Answer. 18% have no trouble.
   65% electrode holders overheat. Springs lose their tension.
   16% not reporting.
   One company makes their own and no trouble experienced.

10. How many A.C. Arc welders do you have? Have you a preference between A.C. and D. C. arc welders?

Answer. 28% use A. C. welders. A large number of those reporting have no experience with A.C. We considered the ones using both A.C. and D.C. welders. 66% prefer D. C. 34% prefer A.C. One man states: Both types good for certain types of work.

11. Is the metal deposited with the A.C. as good as with the D. C. welders? If not, wherein does it vary? Can you use the same electrode with A.C. as with D.C.? If so, what type do you use?

Answer. (only answers considered are from men using both A.C. and D. C. welders).

60% no difference between A.C. and D.C.
20% no data.
20% not reporting.

12. With a given size of electrode and a given value of welding current, will the A.C. welder deposit as much metal as the D.C.? If so, what is the proportion?

Answer. 33% report no difference.
66% report no tests made.

13. Have you made tension, torsion and shear tests of welds made with A.C. welder and D.C. welder? If so, was there any marked advantage in tests in favor of either A.C. or D.C.?

Answer. Of those reporting no one has made a complete analysis of A.C. and D.C. welds.

14. Are your A.C. welders equipped with high frequency for starting the arc?

Answer. None in use.

15. How many different manufacturers' machines do you have?

Answer. All reporting have two different manufacturers' machines. Some 6.

16. If you were buying a new welder, what would be your general specifications?

Answer. 50%—300 amp. portable.
50%—400 amp. portable.
(refer to question 4)

17. Do you use arc for cutting? Why?

Answer. 60% do not use the arc for cutting.
18% use the arc for cutting.
22% prefer gas for cutting.

18. Are A.C. and D.C. both satisfactory for cutting?

Answer. Open question. No one seems to have enough experience to give an opinion.

AUTOMATIC ARC WELDING

1. Do you use automatic metal arc welding?

Answer. 50% yes.
50% no.

2. Do you use bare or coated electrodes?

Answer. 30% use bare electrodes.
70% use coated electrodes.

3. What difficulties have you encountered in any of the following automatic arc welding problems?

a. Inherent characteristics of machine.
b. Buckling of material being welded.
c. Penetration.
d. Breaking after welding.
e. Machining weld.
f. Consistency of results.
g. Of what does your welding consist.

Answer. The only difficulties encountered are in machining the weld. The only criticism offered to the automatic welder is high maintenance of the equipment.

4. Do you use automatic carbon arc welding?

Answer. None reported.

5. What difficulties have you encountered in any of the following automatic carbon arc welding problems?

a. Inherent characteristics of machine.
b. Buckling of material being welded.
c. Penetration.
d. Breaking after welding.
e. Machining weld.
f. Consistency of results.
g. Of what does your welding consist?

6. Do you use single or double arc?

ELECTRODES

1. What sizes and types are mostly used?

Answer. Vary in size from 1/8" to 3/8".
Popular sizes electrode 5/32" and 3/16".
American Welding Society Grade E No. 1B mostly used.

2. Do you use heavily coated, bare or lightly coated electrodes?

Answer. 45% use bare electrodes.
15% use coated electrodes.
40% use both coated and bare electrodes.

3. Do you find any marked advantage with heavily coated electrode, taking into consideration (cost per pound of deposited metal, strength of deposited metal, speed of welding, ductility and soundness)?

Answer. 60% favor of heavy coated electrodes.
40% not in favor of heavy coated electrodes.

4. What percentage of loss do you have due to short ends in welding electrodes?

Answer. Scrap from ends of electrodes runs from 7% to 25%.

5. What length of electrode do you use?

Answer. Most popular lengths are 14 and 18 inches.

6. What grade of electrode do you use for welding or building up.

Answer.

(a) Structural material 70%—.13—.18 C. depending upon work.
(b) Rolls. Varies from .40 C. to 1.40 C. depending upon work.
(c) Steel Castings. Varies from .18 C. to .45 C. depending upon work.
(d) Gears. Varies from .18 C. to .45 C. depending upon work.
(e) Pinions. Varies from .18 C. to .45 C. depending upon work.
(f) Shafts. Varies from .18 C. to .45 C. depending upon work.
(g) Wobblers. Varies from .30 C. to 1.40 C. depending upon work.
with a few using high manganese with high C rod.

7. What electrodes do you use on:

(a) Boilers.

Answer. 60% use a heavy coated rod.
10% use a special electrode.
30% not reported.

(b) Stoker Links.
Answer. 20% use bare electrode.
30% use heavy coated electrode.
50% not reported.

(c) Cast Iron.
Answer. 25% use a coated rod.
18% use bare electrode.
One Company brazes. One company used monel rods.
53% not reported.

8. Do you have a table with current values, size and type of electrodes for each application or do you depend on operator's judgment?
Answer. 50% depend upon the operator's judgment.
25% depend upon the welding supervisor's judgment.
25% not reporting.

OPERATORS

1. Do you have a welding supervisor?
Answer. 87% have a welding supervisor.

2. Do you have a school for your welding operators?
Answer. 50% have a school for welders.

3. Do you have your operators pass a qualification test?
Answer. 75% have a qualification test.

4. Should operators be all qualified on horizontal, vertical and overhead welding?
Answer. 77% yes, operators should be qualified on all types of welding.

5. What basis of comparison do you use in classifying operators?
Answer. (a) Pounds per hour.
(b) Feet per hour of various size fillets. 18% feet per hour. 50% neither feet per hour or pounds deposited per hour, but ability to do neat and good work.

6. Do you make periodical tests of your welding operators?
Answer. 65% make periodical tests of welders.
35% do not make periodical tests.

7. What tests do you make?
(a) If a tensile test is required, what are the requirements?
Answer. 68% tensile tests varies from 45,000 minimum to 50,000 pounds per square inch.
(b) What is your method of inspection and test measurements of fillet welds?
Answer. Visual Inspection gages are universally used.
(c) Are fillet gages used?
Answer. Yes.

8. How do you classify your welders in comparison to other crafts?
Answer. A—Skill. 70% report skilled.
B—Semi-skilled. 20% semi-skilled.

9. What percentage of labor turnover do you have among your operators per year?
Answer. Maximum turnover as reported is 10% per year.

10. Do you use and what results are obtained from various incentive systems of compensation as applied to various types of welding?
Answer. Many different systems are used, each depending upon the nature of work, 20% report piece work.

11. Are the operators responsible for maintenance of machines and equipment? If not, who is responsible?
Answer. 20% welders responsible.
80% welding supervisor or Elec. Dept.

12. Are your arc welder operators also acetylene welders?
Answer. 50% yes.
50% no.

CARBON ARC WELDERS

1. To what extent do you employ carbon arc welding?
Answer. 12% use carbon arc welding.

2. Do you experience any porosity of welds or lack of consistency?
Answer. No.

3. Do you experience any difficulty with carbon in the weld metal?
Answer. No.

4. Do you use a fill-in rod of same chemical composition as base metal?
Answer. No.

5. What is the minimum thickness, maximum thickness of material you are able to weld with the carbon arc?
Answer. 1/4".

RESISTANCE WELDING

1. What is the total K.V.A. of all resistance welders in your plant?
Answer. 68,860 K.V.A. reported.

2. Do you find it necessary to install voltage regulators on large resistance welder units?
Answer. 100% no for those reporting.

3. Do you find it necessary to use motor-generator sets (three phase motor—single phase motor) to furnish power to your resistance welders:
(a) For power factor correction.
(b) To balance single phase on multiple phase line.
(c) To prevent power surges on shop line.
Answer. A.B.C.—100% no for those reporting.

4. Do you find it necessary to use synchronous condensers or static condensers for power factor corrections?
(a) Which do you use?
(b) Are they on the primary (6600-4400-2200) or secondary (550-440-220) side of the transformer?
Answer. For those reporting none in use.

5. Are you paying a penalty for low power factor caused by resistance welder load?
Answer. Not sufficient data and information received to make an answer.

6. Do you notice any fluctuation of voltage at generating station or main sub-station caused by welder load?
Answer. Not to any extent.

7. Do you find your resistance welders cause any more surges on your lines than large motors driving shears, punch presses or rolls, etc.?
Answer. 100% no.

8. Do you find a resistance welder causes as much disturbance as a large motor in starting?
Answer. 100% no.

9. When more than one resistance welder is on a given line, do you experience more fluctuation than a single welder?

Answer. Variety of opinions expressed. Some opinions depending on whether installation was old or new.

10. If you are penalized for your welder load, what is the percentage of penalty?

Answer. A difference of opinion expressed as to the cause of the low power factor.

11. Are your welders full automatic as to current control?

Answer. 50% full automatic.
50% manual control.

12. Do you do seam welding?

Answer. 90% no—10% yes.

13. What is the maximum thickness of plates? Minimum thickness?

Answer. None reported.

14. What is the method of current control you use?

Answer. One reports Tube Control—remainder —Mechanical.

15. Have you tried the thyratron type control for seam welding or spotwelding?

Answer. One reports yes.

16. What success?

Answer. Not reported.

17. In spotwelding is your current control automatically controlled?

Answer. 100% yes for those reporting.

18. In your opinion is resistance welding more reliable and stronger than arc welding?

Answer. 100% yes.

19. If so, for what types of joints and what applications?

Answer. 100% all types.

ATOMIC HYDROGEN WELDING

No reports on Atomic Hydrogen Welding.

ACETYLENE WELDING

1. Do you use acetylene welding for maintenance —production?

Answer. 50% use acetylene for maintenance only.
30% use acetylene for production.
20% not reporting.

2. Do you generate the acetylene?
(a) Purchase acetylene tanks?

Answer. 60% generate their acetylene gas.
25% purchase their acetylene gas.
15% not reporting.

3. What is the minimum thickness, maximum thickness of the material you weld with when using acetylene welders?

Answer. For maintenance no set limits.
Production, maximum reported is ½" plate.

4. What are your costs in percentage to arc welding?

Answer. 40% have no records of costs for comparison between acetylene and arc welding.
50% not reporting.
Of the remaining 10% the cost of acetylene runs from 100% to 135% more than arc welding undoubtedly caused by the purchase of acetylene gas in small quantities.

5. Do you maintain a school for training your acetylene welders?

Answer. 30% maintains a school for acetylene welders.
40% do not maintain a school.
30% not reporting.

6. In welding cast iron, what welding filler rod do you find best?

Answer. 30% use bronze filler rod.
50% not reporting.
20% use cast iron rod.

THERMIT WELDING

1. Do you use thermit welding for maintenance?

Answer. 78% use thermit welding for some maintenance work.
12% not reporting.
10% do not use thermit welding.

2. For what class of work do you use thermit welding?

Answer. Universally used for heavy sections.

3. Do you have a special thermit welder, or can your electric welder do both?

Answer. 50% have a special welder.
25% acetylene welder.
25% arc welder.

4. What success do you have on heavy repairs?

Answer. 100% excellent results.

GENERAL

1. Do you depend upon your ammeter for your current settings or do the operators depend upon their judgment?

Answer. 50% depend upon the judgment of the operator.
25% depend upon both operator's judgment and ammeter.
25% depend upon the ammeter.

2. How many meters on your machines are in working order?

Answer. 65% report meters working.
12% not reporting.
6% report 50% of the meters working.
17% report at least 80% meters working.

3. Do you find the volt-meters, ammeters, etc., the manufacturer puts on his welders a benefit?

Answer. 75% agree they are a benefit. One man states "they would be if they were so mounted so they would last a reasonable time."

4. Are your single operator sets mounted on trucks?

Answer. 95% of all single operator sets are mounted on trucks.

5. How many times are they moved in a month?

Answer. All report at least 30 moves a month, some as many as 50 times a month.

6. Is the design of your trucks such that they are likely to upset during transportation?

Answer. No.

7. Do you have any complaints of your welders causing radio interference?
Answer. 100% no.
8. Do you favor polarity reversing switches?
Answer. 100% yes.
9. What troubles do you experience with cables?
Answer. 50% no trouble.
50% lack of flexibility and insulation.
10. What type or grade of cable do you prefer?
Answer. Specially stranded rubber sheathed cable.
11. Have you standardized on ground clamps? If so, what type or grade?
Answer. 50% have no standard ground clamps.
50% have standard clamp.

The Part Welding Will Play In Metal Houses

By BENNETT CHAPPLE
Vice President, The American Rolling Mill Company, Middletown, Ohio

Presented before the Welding Engineering Division of the A. I. & S. E. E. at the Twenty-ninth Convention in Pittsburgh, Oct. 19, 1933.

I am very happy to be here with you this morning. I wonder if there is a coincidence in the fact that we have the Spiritualists meeting here in the same hotel—I think, perhaps, we are all looking for light. Things are moving so swiftly today that we must peer into the future to see just where we are going and what the trends are that are so vital to us and to civilization in general.

One of the things of great interest to us is the question of housing—the question of shelter. From a quick survey of fundamental necessities of life it is apparent that they can be divided into three things —food, clothing, and shelter. All other things in life are corallary to these three great center pivots on which civilization turns. Now if we look back a little we will find what has happened in the case of food and clothing. We know in the early days it was only possible to raise food by using a forked stick in the loamy valleys of the rivers, and food was a very scarce article. The struggle of mankind was for food, and, therefore, it was predominant in the minds of people. And then something happened. A man invented a plow—a steel plow that turned these great sod prairies of America and Russia and Argentine into great agricultural areas for the growing of food. And food became relatively cheap, and it was no longer a problem to get enough for mankind. True, we have some maldistribution, today, but food as food is not now a problem of civilization.

Then came the question of clothing, which in the old days was quite a problem. We know that women in the pioneer homes spent hours at their spinning wheels making the cloth which clothed the people of that time. And then something happened . . . Eli Whitney went to South Carolina to take a job as a school teacher. When he got there the job was gone. He had nothing to do and no money to get home, and somebody said to him, "If we could only get the seeds out of the cotton by some cheap, easy way, we could do wonderful things with it in making clothing." And so Eli Whitney, who went down to take a job as a tutor developed the cotton gin. Following came other great inventors. Arkwright developed his loom. And today clothing, analyzed from the standpoint of cost of production, is one of the cheapest things we have.

Now let's take up the question of shelter. In the early days we had the caveman with his cave; then man built his habitation of rock and of mud; and later, of logs, if logs were convenient. On the prairies he built sod barns and sod houses. Shelter was not his greatest problem. His difficulty was to get enough clothing and find plenty of food, but shelter was easy to provide.

Now what has happened? As we step up our standards of civilization, shelter has become a most expensive thing. Civilization has outgrown the log cabin. We require many things for our comfort today. We insist on efficient heating and lighting, and air conditioning in our modern home of today. But it is very wonderful that civilization has sensed these things and is working towards them. Shelter and the comfort that goes with it, has awaited the ingenuity of man to come in and do for it what Eli Whitney with his cotton gin and Arkwright with his loom and others have done in the clothing field, and what McCormick with his reaper has done in the food field. We have been very unprogressive in the whole housing proposition.

BENNETT CHAPPLE

During recent years, especially the last ten years, many men have been giving a lot of time and thought to this problem of better shelter at lower cost. I see Mr. Macon* in the audience. He will

* Consulting Editor, "The Iron Age".

recall the dinner we had at the Engineer's Club in New York ten years ago when we sat down and talked over this very problem. Yes, we have been through many phases in the development of shelter. Naturally, representing one of the iron and steel companies, I have been interested in the application of metal to this problem. And why shouldn't metal enter into this great work? It has been so important in so many other phases of our civilization and should step out and be of service to mankind in housing. You know it was only a few years ago that the first skyscraper was built. I knew the man in New York who built it. His name was John Dawson, of the firm of Dawson-Archer. And he, himself, told me that they took the job of building this first skyscraper because they were trying hard to get a start in New York, and had no money to lose and no reputation at stake. No other responsible building contractor in the City of New York at that time would take the job. They couldn't believe a skeleton structure of steel with a veneer of stone would be safe.

That is the very situation we are meeting today in every new development. When a new idea is presented only 10% of our minds are open; the other 90% are shut. I have often made this statement, and I literally believe it—"Progress is often retarded by **the men who know.** It is helped by **the men who know they don't know but are willing to find out.**" That is the history of almost every new development. Experience is not a closed book, but a foundation upon which to build. Today we have our skyscrapers—our changed skylines, but when the first steel man rolled the first structural iron he probably never visualized the changes today. He only made available a material for engineers to use, and the engineers and architects and the great builders came along and used that material in new ways.

About five or six years ago—well, I'll go back farther than that—twenty years ago—men were interested in the development of machinery to roll sheet metal by a continuous process. Passing a bar of iron by hand back and forth, and back and forth through huge rolls, until the desired length and thickness was reached, was a hard, blood-sweating process. Millions of dollars were spent and charged off to profit and loss to develop machinery to roll sheets by a continuous process. In our own company, at Middletown, I saw a pile of blueprints large enough to fill an average room, representing the idea of an engineer who didn't know but who was willing to find out. Finally came the time when we bet six million dollars that that pile of blueprints would produce sheets by a continuous process. Now the continuous mill is an established fact. Great steel companies today have installed these mills. They are in operation. They can produce sheet metal in quantities never dreamed of before.

As I came into this room I looked at these curtains. I have been used to seeing curtains sort of "sawed off" at the first floor, and as I looked at them I said to myself, "My gracious! I never saw such long curtains in all my life." They made me think of the long strips of sheet metal which our continuous mills are rolling, only, of course, the sheets are wider and longer.

What possibilities do sheets of this kind lend to fabrication? Just this: At the World's Fair in Chicago one of the houses—the Armco-Ferro house—is built of sheets that run from the basement to the top of the parapet wall. When they erected that house they just up-ended those sheets and fastened

Armco-Ferro House Exhibited at Century of Progress Exposition in Chicago, 1933

them together. And one thing I should bring out right here—the engineering world has made great progress, but they have been overlooking one little thing; and that was the inherent strength that can be had in thin metal when it is corrugated, especially applied to structural uses. We were used to corrugated roofing sheets, and we were used to corrugated culverts, but when it came to building a load-bearing wall of 20 gage sheets, two stories and a half high, the engineering mind just threw its hands up in the air. It was too startling.

But, I've been following this metal house development for several years. I was convinced that there had to be some method whereby less metal would be used in order to whip the cost. When Mills G. Clark came to me with his method of construction—load bearing strength in sheet metal walls, and a floor with much the same construction—I was greatly interested. His idea of corrugating sheet metal to get load-bearing strength was very simple. It was a simple corrugation—6″; 2″ and back to 6″—a channel formation. We worked it out with a piece of cardboard and finally went to the engineers. They looked kind of pityingly and said: "You know, when you build, the building mustn't fall down. We have to be very safe on that." They turned to the handbook, written forty years ago, which declared for 8″ I-beams or 6″ I-beams and quit.

"Well," I said, "let's make a test. It won't cost much to make a test.

So we made a test. We built that kind of a structure we had in mind, and hauled in pig iron to load it down. I remember one of the engineers had to leave before the test was made. He had to catch a train, and he came over and pulled the lapel of my coat and said, "I'm sorry, Ben, but that thing never will stand up."

But it did. We all do too much advance thinking instead of using the trial and error method. After the idea was proven the engineers pulled their slide rules out and went around and figured out why it was strong. They said, "Why here's the angle of

confluence levering the angle of influence," and there it was! It was all there!

The Armco Ferro house, at "A Century of Progress" was built and has had 1,500,000 people through every room. That's a pretty good test. That house without a beam, without a rafter, without a joist—cellular construction of 20 gage sheets, two stories and a solarium on the roof—has taken care of 1,500,000 visitors and it can take care of that many more next year.

Now I've got a few minutes left and I'll give you some details of the construction, then I'll close. The walls are made of sheets, corrugated and welded together in the factory by spot welding—resistance welding, I guess is the proper word to use. The windows and doors are cut out of the solid walls after they are erected. The floor sections are "Z" shaped sections. Each sheet laps over the next one, and the welding is done both top and bottom. It presented quite a problem in welding. It required a machine that would weld top and bottom, through a 5½", 20 gage web and do a perfect job without burning the metal. John Skove, the engineer of the Insulated Steel Construction Company, worked out a machine to do the job when the electrical industry generally threw up its hand. The machine is working very successfully. It was built by the Federal Machine and Welder Company.

I said to Skove, "What was your greatest problem?"

"Well," he said, "I had to reduce the juice so it wouldn't burn the metal. When I reduced that juice I had to use a lot of pressure, because with a little bit of juice you need a whole lot of pressure."

He put 1200 pounds pressure here at the top and here at the bottom, with just a nice little dribble of juice and he got very good results. The thing I am getting at is this: I don't know anything about welding, but it is apparent if you get too much juice, you burn up the metal. When you're dealing with sheet steel you've got to learn how to dribble your electricity.

The wall sections are welded the same way. Here the web is made of two pieces of metal lying side by side. Why in the world doesn't it arc between them? Well, the juice is too faint. It only arcs right at the top and bottom where the pressure is, and it floats through the double web just like a chip down a stream. No trouble at all. Maybe you've got a better answer. Have it your own way.

What are you going to do in the future, you men who are in the welding industry, to solve the necessary things that are needed in house construction. I'll say this to you: The metal house—the metal chassis—is here. It's come to stay. It's a logical material, whether you cover your house with veneer brick or with stucco or nail wood onto it. When you're using a wall of 20 gage sheet you can nail anything onto it. It's the little things that help business. Your problem and my problem is to perfect this metal chassis. Whatever we can do to sheet metal to weld it, to button it together, in an easy, quick, convenient form, is going to be the great salvation of the metal chassis for low cost home.

You know they have been doing so many wonderful things that my imagination just refuses to place limits anywhere. I wonder with this great influx of electricity if the time won't come when they will have great wireless power generating stations operating so the mechanic can go on the job with a little bit of a device in his pocket that gathers this wireless power and shoot it around to do anything he pleases. And when he wants to weld something he just picks up this little device and welds it, getting his power out of the air. If you think that's a crazy idea, just think what wireless is anyway.

We need all the open-minded engineering in the world, and especially in the welding field, because welding is absolutely necessary to the future of the iron and steel industry. We have gone beyond the older methods. We must come to newer methods where we can get new economies.

Now, I'll try to answer any questions. I'm just like one of those colored boys ducking balls in a side show—I can duck my head awfully fast.

A Guide For Equipment Builders Servicing The Iron And Steel Industry

Many Rolling Mills in the Iron and Steel Industry require partial and some complete rehabilitation. The Rolling Mills using steam engines and hydraulic equipment are barely able to meet the present day requirements. Since 1920 the application of the electric motor drive has advanced steadily, and today, no steel plant entertains the thought of any other type of drive, in their expansions or their rehabilitations.

The following statistics have been prepared to indicate what may be expected in the future.

First, we have the Steel Centers and then the cities. Next the ingot capacity in tons. We then list the number of main motor drives, the horse power of the drives and then the extent to which the particular city has been modernized with main electric motor drives.

You will note that in some of the representative cities with large tonnage capacity there are averages as low as 17.12 and 18.57. These figures represent modern plants. You will also note the higher averages. These plants require main drives for their rolling mills. This means rehabilitation and it is estimated that the rolling mills of this country will require approximately 2½ million of main drive electric horse power.

It does not follow however that the cities shown are not equipped with electrified auxiliary electric drives. For example a plant showing 300 tons per

electric drive horsepower may be completely electrified with electric auxiliary horsepower.

The statistics furnished are not to be considered as one hundred per cent correct, they are however close enough to be used for estimating purposes.

Pittsburgh District

Location	Total Steel Ingot Tonnage	No. of Main Drives	Total Elec. Main Drive H.P.	Tons per one Main Drive Elec. H.P.
Brackenridge, Pa.	338,000	12	17,600	19.2
Butler, Pa.	570,000	18	26,100	21.83
Vandergrift, Pa.	336,000	2	1,200	280.00
Donora, Pa.	627,000	4	18,000	34.83
Johnstown, Pa.	1,824,000	32	29,550	61.72
Munhall, Pa.	2,613,000	10	52,000	50.25
Duquesne, Pa.	1,510,000	5	7,350	205.42
Clairton, Pa.	720,000	0	0	0
Braddock, Pa.	1,445,000	2	3,000	481.66
Pittsburgh, Pa.	2,124,000	11	11,750	180.76
Oakmont, Pa.	85,000	3	2,250	37.82
Aliquippa, Pa.	1,428,700	34	64,650	21.78
Latrobe, Pa.	15,800	3	1,600	9.87
Midland, Pa.	660,000	8	8,700	75.86
Monessen, Pa.	720,000	24	21,520	33.45
McKeesport, Pa.	716,000	23	30,740	23.27
Bridgeville, Pa.	50,700	6	3,550	14.28
	15,783,200	197	299,560	52.67

Eastern District

Worcester, Mass.	190,000	8	11,150	17.04
Bridgeport, Conn.	120,000	10	10,300	11.65
Harrison, New Jersey	87,600	5	3,350	26.14
Watervliet, New York	45,000	6	3,900	11.53
Newark, New Jersey	1,500	0	0	0
Phillipsdale, R. I.	39,000	6	4,400	8.86
	483,100	35	33,100	14.59

Philadelphia District

Ivy Rock, Pa.	600,000	6	6,300	95.23
Pencoyd, Pa.	240,000	0	0	0.00
Sparrows Point, Md.	1,749,000	39	102,150	17.12
Bethlehem, Pa.	1,681,000	18	20,190	83.25
Steelton, Pa.	660,000	6	18,200	36.26
Reading, Pa.	43,000	9	6,300	6.83
Philadelphia, Pa.	216,000	1	500	432.00
Pottsville, Pa.	144,000	1	400	360.00
Harrisburg, Pa.	80,000	2	1,850	43.24
Phoenixville, Pa.	223,800	3	9,000	24.86
Trenton, N. J.	231,000	9	9,850	23.45
Baltimore, Md.	20,000	2	1,000	20.00
Claymont, Del.	360,000	2	5,000	72.00
Burnham, Pa.	145,100	0	0	0.00
Coatesville, Pa.	1,022,500	14	14,950	68.39
	7,414,600	112	195,690	37.88

St. Louis District

St. Louis, Mo.	115,000	3	2,200	52.27
Granite City, Ill.	360,000	4	8,500	42.35
Kansas City, Mo.	210,000	22	20,275	10.35
Alton, Ill.	225,000	6	4,940	45.5
	910,000	35	35,915	22.82

Cleveland District

Cleveland, O.	2,340,000	61	99,935	23.41
Lorain, O.	1,500,000	20	33,800	44.37
Detroit, Mich.	1,419,000*	59	95,700	14.81
Mansfield, O.	333,000	7	9,500	34.73
Massillon, O.	450,000	21	23,000	19.56
Canton, O.	1,157,200	50	53,780	21.52
	7,196,200	218	315,715	22.7

*Estimated.

Valley District

Youngstown, O.	5,480,000	83	117,785	46.61
Lowellville, O.	450,000	2	6,900	65.21
Warren, O.	756,000	32	44,200	17.08
Farrell, Pa.	780,000	1	4,000	195.00
New Castle, Pa.	500,000	0	0	0.00
	7,966,000	118	172,885	46.07

Wheeling District

Follansbee, W. Va.	90,000	3	2,500	36.00
Toronto, O.	110,000	4	5,500	20.00
Steubenville, O.	900,000	24	43,350	20.76
Mingo Junction, O.	600,000	1	1,500	400.00
Weirton, W. Va.	1,250,000	49	57,000	21.92
Benwood, W. Va.	296,000	4	6,500	45.53
	3,246,600	85	116,350	27.72

Chicago District

Duluth, Minn.	540,000	5	13,100	41.22
New Castle, Ind.	10,000	2	600	16.66
Gary, Ind.	4,428,000	70	149,170	29.68
Chicago, Ill.	6,958,420	72	176,400	39.44
Joliet, Ill.	600,000	1	1,500	400.00
Indiana Harbor	2,900,000	93	187,650	15.45
Peoria, Ill.	180,000	4	7,290	24.69
Kokomo, Ind.	250,000	8	15,650	15.98
	15,866,420	255	551,360	28.77

Ohio River District

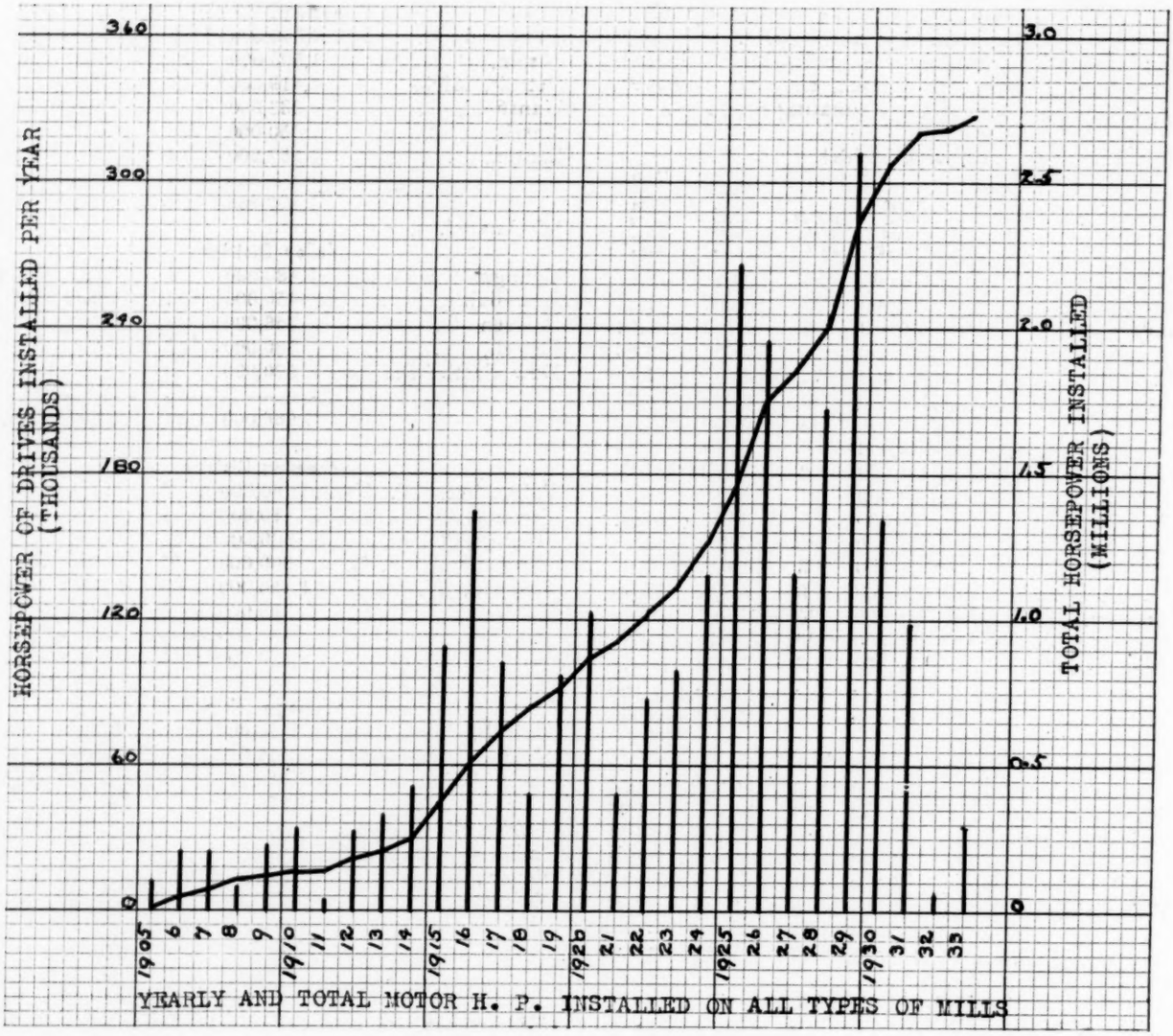
Middletown, O.	508,700	33	23,650	21.5
Ashland, Ky.	588,000	18	29,500	19.93
Newport, Ky.	360,000	4	7,100	50.4
Portsmouth, O.	418,000	6	11,870	35.21
	1,874,700	61	72,120	25.99

Buffalo District

Lackawanna, N. Y.	1,980,000	39	106,600	18.57
Buffalo, N. Y.	735,000	21	28,770	25.19
Lockport, N. Y.	11,000	4	1,850	5.94
Titusville, Pa.	9,800	1	400	24.5
Cortland, N. Y.	35,000	0	0	0.00
Syracuse, N. Y.	66,800	5	5,050	13.22
	2,837,600	70	142,670	19.88

Southern District

Alabama City, Ala.	280,000	17	28,200	9.9
Atlanta, Ga.	100,000	9	9,950	10.04
Ensley, Ala.	1,020,000	1	5,000	204.00
Fairfield, Ala.	732,000	29	48,300	15.13
Richmond, Va.	5,000	2	885	5.65
	2,137,000	58	92,335	23.14



Western District

San Francisco, Cal.	155,000	6	5,850	26.49
Youngstown, Wash.	140,000	4	5,400	25.92
Los Angeles, Cal.	85,000	5	4,350	19.54
Fort Worth, Tex.	11,000	1	500	22.00
Tulsa, Okla.	60,000	1	1,200	50.00
Pueblo, Colo.	898,000	14	24,750	36.28
Pittsburgh, Cal.	176,000	12	20,800	8.46
Torrance, Cal.	164,000	7	7,550	21.72
Emeryville, Cal.	60,000	3	1,700	35.29
Seattle, Wash.	15,000	0	0	0.00
Sacramento, Cal.	9,000	0	0	0.00
Midvale, Utah	46,000	0	0	0.00
	1,819,000	53	72,100	25.58

NON-INTEGRATED PLANTS

Location	Capacity Tons Finished Rolled Products	No. of Main Roll Drives	Total Elec. H.P. of Main Drives	Tons per One Main Drive Elec. H.P.
Ambridge, Pa.	600,000	23	37,800	15.87
Cleveland, O.	519,000	48	40,350	12.83
Gary, Ind.	1,403,900	64	99,825	14.06
Monroe, Mich.	200,000	6	6,000	33.33
McKeesport, Pa.	180,000	6	6,900	26.08
Riverdale, Ill.	450,000	21	22,000	20.45
Sharon, Pa.	424,000	20	23,150	18.31
Ellwood City, Pa.	350,000	12	15,000	23.33
	4,126,000	200	251,025	16.43

The Steel Industry's Expenditures In Normal Operating Years

▲

Electrical Expenditures

The Steel Industry has installed approximately 194,000 motors; 234,000 armatures; 776,000 field coils; 243,000 commutators; 11,000,000 armature coils that requires maintenance material for their up-keep.

Approximately $1,000,000 is spent in normal operating years for material in maintenance on electrical control apparatus.

In normal operating years there are approximately 78,000 motor failures of which 49,920 are armature coil failures, and 27,456 are commutator failures.

Main drive motors constitutes 2,500,000 HP, and repairs to these motors average approximately 10 cents per HP per year.

Approximately $444,325 is spent annually for enclosed renewable fuses. For enclosed fuses over 600 volts, about $142,260.

Safety switch business averages about $500,000 yearly.

	Approximate Annual Expenditures
Lamps of illumination	$ 500,000
Carbon brushes	700,000
Circuit breakers	500,000
Portable electric tools	600,000
Lamp sockets, receptacles, reflectors	450,000
Wiring for motors	800,000
Transmission and auxiliary (towers, insulators)	700,000
Generating switch boards	350,000
Motor expansion and replacements	4,000,000
Control equipment for expansion & replacements require about	2,000,000
Electrical inventories in steel mills totals about	$35,500,000
One prominent steel plant's power houses generated 440,000,000 KW hours for	$3,800,000

The "prime movers" consisted of steam engines, gas engines, low and high pressure turbines.

Prices in some steel plants for electric power are from 39 cents to 45 cents per finished ton.

Over a period of 25 years $3,500,000 was spent annually for electrical power house equipment.

By-Product Coke Ovens

To produce 7,500,000 tons of coke, the approximate costs are—

	Approximate Cost
Material used in repairs & maintenance	$ 510,000
Rebuilding fund for coke ovens	487,000
Tools and supplies	150,000
Steam costs	810,000

Blast Furnaces

To produce 5,000,000 tons of pig iron, the approximate costs are—

Material used in repairs & maintenance	$ 663,000
Refractories up-keep	150,000
Relining fund set aside	1,000,000
Steam costs	2,500,000

Open Hearth Furnaces

	Approximate Cost Per Ton
Material used in repairs and maintenance average	15c
Tools, lubricants, & miscellaneous supplies	8c to 14c
Refractories average	37c
Furnace and mixer repairs average	85c
Moulds average about	16c

Rolling Mills

Rail Mills	Approximate Cost Per Ton
Material used in maintenance & repairs	30c to 42c
Roll expense,*	30c to 50c

Universal Plate Mill

Material used in maintenance & repairs	47c to 68c
Roll expense,*	47c to 53c

Sheet Bar & Tin Mills

Material used in maintenance & repairs	21c to 45c
Roll expense,*	6c to 10c

Sheared Plate Mills

Material used in maintenance & repairs	66c to 82c
Heating costs average	20c to 33c

Slabbing Mills

Material used in maintenance & repairs	17c to 26c
Roll expense,*	3c to 7c

Blooming Mills

Material used in maintenance & repairs	14c to 36c
Roll expense,*	4c

Soaking Pits

Material used in maintenance & repairs	9c

*Not to be accepted as average costs. Presented for estimating purposes only.

Miscellaneous Data

Steel plants and their auxiliaries utilize as much as 50% of all refractories manufactured in the United States. The Steel Industry uses about $30,000,000 worth of refractories each year.

For every 2,000 tons of coke produced 2.8 tons of refractories are used.

For every 2,083 tons of pig iron produced 12 tons of refractories are used.

For every 3,750 tons of steel produced 388 tons of dolomite and refractories are used.

There are approximately 2,500 furnaces using pulverized fuel in the Iron and Steel Industry.

Steel plants, including coke ovens, use approximately 21% of all the coal mined in the U. S.

Electric melting furnaces for steel use from 548 to 687 KW hours per ton. Electrode consumption 7½ lbs. per ton. (Graphite) 16 lbs. per ton. (Amphorous)

It is estimated that with the use of open hearth furnace fuel control a savings from $16,000 to $19,000 may be made per furnace.

In 1909 the ingot capacity of the Iron and Steel Industry was 29,000,000 tons.

In 1932 the ingot capacity of the Iron & Steel Industry was 71,000,000 tons.

In 1909 the main drive electrical HP was 26,650.

In 1932 the main drive electrical HP was 2,500,000.

Since 1919 there have been 1,281 rolling mills installed.

Since 1917 there have been 20 new blast furnaces built.

Since 1920 there have been 150 blast furnaces remodeled.

Since 1923 there have been 121 blast furnaces dismantled.

Since 1913 there have been 561 open hearths built

The average life of cables on cranes, capacity from 30 to 160 tons, is estimated to be 8 months.

The average life of cables on cranes, capacity from 165 to 275 tons, is estimated to be 13 months.

There are in the Iron & Steel Industry, approximately 18,000 cranes that need overhauling.

In a normal operating year there has been as much as $3,500,000 spent for electric overhead traveling cranes.

From figures taken from papers presented before our Association, it requires more money to operate hydraulically than electrically.

It is estimated that there is a potential market for $15,000,000 worth of lubricating devices in the Iron & Steel Industry. It is claimed that with the use of proper lubricants a savings in power costs will reach 25%; the Coal Industry claims 40% savings; the Metal Mining Industry claims 16% savings.

In replacement, repairing, and depreciation of machinery and apparatus in the Iron & Steel Industry, it is claimed that with the use of proper lubricants a savings from 15% to 22% may be made; the Coal Industry claims 38% savings; the Metal Mining Industry claims 58%.

In the last ten years, with the use of proper effective lubrication, grease and oil costs have been reduced as much as 8c per finished ton shipped. Some steel plants operate as low as 5c per finished ton for lubricants.

Anti-Friction Bearings In Connection With Cold Mills

By C. J. KLEIN
Chief Engineer, Weirton Steel Company, Weirton, W. Va.

Presented before the Electrical and Mechanical Engineering Divisions of the A. I. & S. E. E. at the Twenty-ninth Convention in Pittsburgh, October 18, 1933.

The need of cold rolled strip in coils having a width greater than could be produced on existing two-high mills led to the design and installation of mills having more than two rolls back in 1923 which since have revolutionized the sheet and tin plate industry to a great extent.

C. J. KLEIN

The fundamental reason for the design of mills having more than two rolls was to make the diameter of the working rolls, or in other words, the rolls in contact with the metal to be rolled, as small as possible in order to reduce the contact areas of the roll and thereby reduce the pressure between the rolls and to make the backing-up rolls of sufficient diameter to withstand the rolling pressure.

The first two installations of wide backed-up roll type cold mills used friction bearings on all rolls and it was quite essential on this type of mill to keep the working roll diameters as small as possible in order to keep the back roll bearing pressures within their limits. This type of mill proved its practicabil-

ity and immediately steps were taken to improve its value to a greater extent by the use of anti-friction bearings on the backing-up rolls. The roller bearing manufacturers, being on the alert, were quick to see the possibilities in this new field and having bearings in actual operation on other types of equipment carrying loads equal to the anticipated rolling pressures, could see no difficulty in producing roller bearings large enough to withstand these pressures.

At that time very little data was available as to the pressures that would be encountered in the rolling of this material and also to what extent this type of bearing would withstand the impacts due to cobbles, etc., in the ordinary operation of a mill of this type. There were two important things to decide in the design of this new mill, namely, the diameter of the backing-up roll neck and the size of the roller bearings. After investigating the data available at that time it was decided to make the necks 18" in diameter, the roller bearing manufacturer designed a bearing to suit with the following dimensions: 18" ID—27" OD—7½" overall length, there being 33 rollers, 1¾" diameter x 5¼" long. Having the OD of the roller bearing fixed, a chuck was designed to contain same and this practically determined the diameter of the back roll body. The size of the first backed-up roll wide strip mill had 14" diameter work rolls and 30" diameter back rolls, and 48" long bodies.

The enormous advantages which quickly indicated themselves in the operation of the first backed-up roll anti-friction bearing mill in the way of power savings, more uniform gauges, higher rolling speeds, etc., led to the building of a large number of this type of mill. It was found upon the first installation that larger size roller bearings were advisable and the second cold mill built had 18" ID x 28¾" OD x 12¼" long bearings with 26 2½" diameter x 10" long rollers, the mill size being 14" and 32" diameter x 48" long rolls. It developed later that less trouble was encountered in the breakage of roll necks than roller bearings, and in some cases the necks were reduced in diameter and this additional space used for roller bearings.

Due to the large number of mills of this type in operation, sufficient data is now available to determine the size of bearings necessary for a given operation. This data is made available due to several types of bearing pressure indicators now in use as well as operating data on the life and service of bearings in operation. The size and capacity of bearings is ever on the increase, the largest one to date being 30" ID, 48" OD x 32" long.

In going over the various mills which have been built and placed in operation, the question naturally arises in one's mind as to why there is such a large variation in the size of back roll bearings in mills doing practically the same work. There are various explanations for this condition, namely, life of bearings, frequency of inspection, care in cleaning and assembly, lubrication, necessity of keeping foreign matter from getting into bearings, especially while in operation.

In the early design of mills, it was considered sufficient to place roller bearings on the back-up rolls only, it being contended that the work rolls had very little bearing load and that friction bearings would be satisfactory, especially due to the fact that a smaller diameter roll could be used. This assumption was correct as far as radial loads were concerned but it was soon discovered that the rolls could not be set accurately enough to eliminate end thrust and that 4" to 6" of brass would be worn out in some cases due to end thrust during the life of a friction type radial bearing.

This thrust wear would naturally heat up the body of the roll, thereby causing roll damage as well as causing the mill to lose its shape with the result of producing wavy edge material or a reduction in tonnage through the mill due to running slower or stopping entirely. The 14" diameter work roll which had been used on practically all mills having 36" to 48" long roll bodies was increased to as much as 18" in diameter and the neck diameters which were found to be larger than necessary were reduced thereby allowing for the mounting of roller bearings. The change from friction to anti-friction bearings on work rolls permitted an increase in rolling speeds and reduced roll costs as well as power consumption. However, this change-over on existing mills had its handicaps due to the fact that it was necessary to practically provide entirely new fillings in the windows, also much greater care was necessitated in changing rolls due to possible breakage of roller bearing in handling, etc. In the design of new mills these conidtions do not exist to such a great extent.

Due to the rapidity with which work roll changes must be made, it is desirable to have the rolls fitted with bearings ready for installation. On account of the frequent changes of bearings from one roll to another great care and attention should be given to the design of bearing seals. Various methods have been employed, the most common being piston rings, leather packings, composition rings, as well as various types of labyrinths. The most practical type of seal is one which is protected from damage in handling off and on the neck and which requires no guiding of any kind in mounting, the efficiency of the seal is of prime importance.

The design of the bearing and mounting should be made so that no loose parts are free to fall out in handling and also openings of any kind should be avoided in order to retain the lubricant in the mounting and foreign matter from getting into same.

The same consideration in the design of back roll bearing mounting should be used as in the work roll. The balancing of the back roll is of importance due to the fact that an improperly balanced roll will cause impact on the backing-up roller bearing due to jumping; this is quite important where sheets are rolled. Careful attention should be given to method of changing rolls as damage to bearings can result in poor handling facilities. The frequency of bearing inspection is quite important and this can only be determined individually as each mill has various characteristics in the way of loading, speed, percentage of operating time, etc. While the later installations of cold mills have pressure indicating mechanisms care must be taken by the operator not to run the screws on the back roll bearings too tight as sufficient power is available to break bearings.

Central hand-operated grease gun outfits were installed on most of the mills; in the beginning with this type of lubrication applications were made anywhere from one to eight hours. The automatic type of system has come to play an important part in

lubrication; with this system it is possible to set up a cycle of feed at any frequency desired. It is thought advisable to lubricate at intervals of from fifteen to thirty minutes in smaller quantities, thereby more effectively sealing the bearings. The amount of lubricant to feed can be determined through actual operation and the automatic system is the most accurate in the amount charged. Care in the handling of grease is of importance as a piece of foreign matter can either clog up the lubricating system or if it passes into the bearing, can damage same.

A department for the handling of roller bearings is quite advantageous as it can be equipped for the proper cleaning, inspection and assembling of the bearings. Also, men doing nothing but this type of work become more efficient at same. A large saving due to proper inspection of bearings at specified intervals can be made by this procedure.

Anti-friction bearings are no longer confined to rolls as they are now used in the reduction drives, pinion stands, screwdowns, coil boxes, reel drives, and other miscellaneous equipment in connection with cold mills to a decided advantage.

While the general content of this paper applies to four-high mills, as they are the most widely used, the same holds true in general on two-high roller bearing mills, three-high roller bearing mills, cluster mills and the various other adaptations of mounting anti-friction bearings in connection with cold rolling mills.

Discussion

By W. R. CLARK
Works Manager, Mill Products Division, Bridgeport Brass Co., Bridgeport, Conn.

I have had considerable experience in the use of roller bearings on cold mills for rolling brass, and two of the points brought out in Mr. Klein's paper were of interest to me because of some of the things which the Bridgeport Brass Company has learned in the operation of these mills.

These have to do with the mounting of the bearings and with the method of lubrication. On one mill in particular we had a considerable amount of bearing failure, some bearings failing after three or four months of operation. We did not regularly overload the mill beyond the rated capacity of these bearings, but they seemed to give altogether more trouble than should have been expected. After carefully studying the situation we made two changes, which eliminated our difficulties.

In the case of the bottom roll we determined our mounting was too rigid and we therefore inserted a hardened steel button in the housing and another one in the bottom of the chuck. One of these was made slightly spherical so that the load on the bearing would be transmitted uniformly throughout its length by permitting the chuck to rock on its spherical button.

We had been lubricating our bearings with grease and in taking them down there was some evidence that corrosion had taken place. Although we had labyrinth seals and oil slingers on the bearings some of the water used on the rolls during the process of rolling evidently found its way into the bearings. We therefore decided to put in a circulating oil system. These bearings are now equipped with a gravity feed circulating oiling system using 100% heavy Pennsylvania oil.

There are two tanks, one below the floor level to take the oil return and one overhead. The oil is pumped by means of a geared pump through a filter to the overhead tank, from whence it feeds by gravity to the bearings through a snap lever drip and sight feed valves.

On Wednesday of each week one pint of an emulsifying oil is put directly into each bearing with a pressure gun. This is done to absorb the moisture that may have collected in the bearings through condensation or directly from the water used on the faces of the rolls and the work roll necks having worked through the seal.

By B. R. SHOVER
Consulting Engineer, Pittsburgh, Pa.

I'm going to say one thing here in relation to a point brought up. I think it was stated in Mr. Klein's paper that the back-up mills were designed primarily to reduce the bearing pressure on the rolls by using smaller rolls. There have been some men that have objected to the truth of that, and I am going to take advantage of this to have some of you think a little about it. The objection is this: that the diameter of the roll has nothing whatever to do with the bearing pressure so long as you have anti-friction bearings and so long as the same reduction at the same delivery speed is made. In other words, the reduction and speed determine the work; and, if the work is the same,—the same units,—the pressure must be within very small limits of the same. Now that may be true or it may not be true, but it's well worth thinking about.

Major Improvements Iron and Steel Industry 1928-1933 Inclusive

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The following data and information was prepared to indicate the tremendous purchasing power of the Iron and Steel Industry.

This information represents capital goods or major equipment used to process and produce Iron and Steel.

It is estimated that the equipment installed represents conservatively $500,000,000.00.

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Acme Steel Company

Riverdale, Illinois

Electro-Galvanizing equipment, installed, 1928.

1-10" Hot Strip Mill, completed, 1929.

1-16"-4-High Tandem Cold Strip Mill with reel, completed, 1929.

1-12" Cold Strip Mill, completed, 1930.

12-Motors, 7,300 Main Drive Horsepower, Installed 1929.

Normalizing Furnaces for Strip Steel and Annealing Furnaces for Rustless Steel Installed 1930.

Alan Wood Steel Company

Swedeland, Pa.

Blast Furnace Stack #2, remodeled, 1929.

41-Koppers-Becker-By-Product Coke Ovens, completed, 1929.

Equipment for screening coke installed, 1929.

1-Sintering Plant at blast furnaces, completed, 1930.

2-Blast Furnace Stacks #2 and #3, remodeled, 1933.

Allegheny Steel Company

Brackenridge, Pa.

2-Motors, 2,600 Main Drive Horsepower, Installed 1929.

4-Electric Melting Furnaces, Installed 1929.

7-Motors, 12,700 Main Drive Horsepower, Installed, 1931.

1-30"-4-High 4-Stand and 28"-2-High 3-Stand Continuous Hot Strip Mill with a capacity of 800 tons in 8 hours, completed, 1932.

American Rolling Mill Company

Ashland, Kentucky

Blast Furnace Stack, "Norton," Remodeled, 1929.

Blast Furnace Stack #1, remodeled, 1929.

Butler, Pennsylvania

3-Stands of Rough Sheet Mill Revamped, 1929.

1-Motor-4,000 Main Drive Horsepower, Installed 1929.

2-Motors-1,400 Main Drive Horsepower, Installed, 1930.

The hot strip mill installed in 1926 was revamped, the four 4-High Stands were widened from 42" to 48" and the mill speed increased, during 1929.

1-Cold Strip Mill consisting of two trains viz., 2-Stands, 42"-4-High tandem and 1-Stand 42" Single were installed during 1929.

7-Motors, 2,500 Main Drive Horsepower, installed, 1929.

1-7-Hole Regenerative Soaking Pit Installed, 1929.

Two Continuous Tunnel Type Box Annealing Furnaces, Three Blue Annealing Furnaces, Three Continuous Pickling Machines and one Pickling tank were installed, 1929.

1-Cold Sheet Mill Consisting of 13-Stands of 26" Cold Rolls Installed 1929.

1-20" Steckel 4-High Cold Strip Mill Installed, 1932.

1-26"x58" 2-High Cold Sheet Mill from Ashland Kentucky Plant installed, 1933.

Middletown, Ohio

1-Continuous Hot Strip Mill Consisting of 18"-2-High-4-Stands, 18"-4-High-3-Stands and 18"-4-High-4-Stands completed in 1929.

11-Motors-21,800 Main Drive Horsepower, Installed 1927-28-29.

1-Motor-400-Main Drive Horsepower, Installed, 1929.

American Sheet and Tin Plate Company

Mercer Works, Farrell, Pa.

1-84"-4-High-Cold Sheet Mill Installed, 1929.

1-Motor-400-Main Drive Horsepower, Installed, 1929.

Gary Works, Gary, Indiana

1-Cold Strip Mill Consisting of 1-Stand of 42" 4-High Rolls and 1-Planishing Stand 42" 4-High Rolls Installed in 1931 was revamped in 1933.

2-Motors, 1,175 Main Drive Horsepower, Installed 1931.

3-Motors, 2,200 Main Drive Horsepower, installed, 1932.

1-3-High Hot Sheet Mill Completed 1933.

2-84"-4-High Single Stand Cold Mills with reels for rolling tin plate gages from hot rolled coiled strip were installed during 1933.

1-Cold Strip Mill consisting of 1-Stand, 16"x49"x 42"-4-High with reels for rolling tin plate from coiled strip installed 1933.

7-Motors, 6,100 Main Drive Horsepower, installed, 1933.

Continuous Pack and Pair Furnaces and roller and catchers tables, installed on Sheet Mills, 1930-31-32.

Wood Works, McKeesport, Pa.

1-55"-4-High-Single Stand Cold Sheet Mill, the first 4-High Mill to have anti-friction bearings on the work rolls, installed, 1928.

1-Motor-400 Main Drive Horsepower, installed, 1927.

Vandergrift, Pa.

2-Motors-1200 Main Drive Horsepower Installed 1929.

1-Motor-400-Main Drive Horsepower, Installed, 1933.

1-3-High Hot Sheet Mill Installed, 1933.

Continuous Pack and Pair Furnaces and roller and catchers tables, installed on Sheet Mills, 1930-31-32.

American Steel and Wire Company

Cleveland, Ohio

1-10" Hot Strip Mill, Completed, 1928.

15-Motors-9,000 Main Drive Horsepower, Installed, 1928.

1-Motor-3,000 Main Drive Horsepower, Installed, 1929.

4-Motors, 1,600 Main Drive Horsepower, installed 1930.

1-26"-4-High-4-Stand Tandem Cold Strip Mill, Installed, 1931.

1-16"-4-High-4-Stand Tandem Cold Strip Mill, Installed, 1931.

1-7½"-Steckel Cold Strip Mill, Installed, 1931.

Donora, Pa.

4-Basic Open Hearth Furnaces, rebuilt, 1928.

Equipment to permit pouring heavy heats in Open Hearth Department, installed, 1930.

1-24" Billet Mill, Completed, 1931.

2-Rod Mills, Completed, 1931.

4-Motors-18,000 Main Drive Horsepower, installed, 1931.

Fairfield, Alabama

2-Continuous Heating Furnaces rebuilt to use natural gas, 1930.

Worcester, Mass.

1-10" Rod Mill, rebuilt, 1928.

10-Motors, 10,700 Main Drive Horsepower, purchased in 1926-27, Installed, 1928.

1-7½"-4-High Steckel Cold Strip Mill, Installed, 1931.

American Tube and Stamping Company

Bridgeport, Connecticut

5-Motors-4,900 Main Drive Horsepower, Installed, 1929.

1-12"-11-Stand Cross Country Strip Mill, completed, 1930.

1-Motor-2,000 Main Drive Horsepower, installed, 1930.

Andrews Steel Company

Newport, Kentucky

1-Motor-3,000 Main Drive Horsepower, Installed, 1932.

1-34" Blooming Mill, Completed, 1933.

1-26"-Bar Mill, Completed, 1933.

1-24"-Bar Mill, Completed, 1933.

1-30"-Hot Sheet Mill, Completed, 1933.

Apollo Steel Company

Apollo, Pa.

3-26" Cold Sheet Mills for rolling full finished automobile sheets with necessary furnaces and equipment for normalizing, installed, 1929.

1-Motor-500 Main Drive Horsepower, Installed 1929.

Atlantic Steel Corporation

Atlanta, Georgia

1-10" Merchant Mill, Completed, 1928.

1-Motor-800 Main Drive Horsepower, Installed, 1928.

1-14" Edging Mill, Completed, 1929.

3-60-Ton Basic Open Hearth Furnaces, Completed, 1930.

3-Heating Furnaces equipped to burn natural gas, 1930.

1-60-Ton Basic Open Hearth Furnace remodeled and equipped to burn natural gas instead of producer gas, 1933.

Bancroft and Martin Company

Portland, Maine

1-Motor-500-Main Drive Horsepower, Installed, 1929.

Babcock and Wilcox Tube Company

Beaver Falls, Pa.

1-Motor-500 Main Drive Horsepower, Installed, 1929.

1-Motor-450 Main Drive Horsepower, Installed, 1930.

2-Motors-1,200 Main Drive Horsepower, Installed, 1931.

1-Diescher Type Seamless Tube Mill placed in operation, 1932.

Bethlehem Steel Company

Bethlehem, Pa.

3-Blast Furnaces, Stacks "D", "F" and "G", remodeled, 1928.

2-Blast Furnaces, Stacks "A" and "B", remodeled, 1929.

4-¼-Ton Electric Melting Furnaces, Installed, 1929.

1-Motor-300-Main Drive Horsepower, Installed, 1929.

1-Sintering Plant, Installed, 1930.

1-Bethlehem Twin Gas Blowing Engine, Installed, 1932.

Johnstown, Pa.

Blast Furnace Stack "D", rebuilt, 1928.

3-2-Strand Pig Casting Machines, Installed, 1928.

Improvements and Additions Made to Mold Yard During, 1928.

2-Waste Heat Boilers installed at Franklin Division Open Hearth Department, 1928.

24-Soaking Pits, installed, 1929.

2-110,000 C. F. M. Turbo Blowers for three blast furnaces, installed, 1930.

77-Koppers-Becker Coke Ovens with screening plant, coke wharf, coke bin and quenching station, installed, 1930.

Blast Furnace Stack "G", rebuilt, 1930.

48" Universal Plate Mill, remodeled, 1930.

Open Hearth Department at Franklin Division equipped with New Ladle Cranes and Charging Machines for heavier heats, during, 1930.

Heat Treating Department installed in Wheel Mills, 1932.

1-Motor, 4,000 Main Drive Horsepower for Rod Mill, Lower Works, January 1, 1934.

Danville, Pa.

2-Motors-3,000 Main Drive Horsepower, Installed, 1928.

Lackawanna, New York

1-Rail and Structural Mill consisting of 1-36"-2-High Roughing and 2-32"-2-High Finishing Stands were completed in 1928.

2-Motors-12,000 Main Drive Horsepower purchased in 1927 were Installed, 1928.

2-Waste Heat Boilers Installed on Open Hearth Furnaces, 1928.

1-72"-Cold Saw for Shipping Yard installed, 1928.

2-Ingot Strippers for Open Hearth and Bessemer Steel Departments installed, 1928.

6-150-Ton Basic Open Hearth Furnaces were completed, 1930.

3-Bethlehem Twin Blowing Gas Engines were installed, 1930.

1-Continuous Roughing Slab, Billet and Sheet Bar Mill consisting of a Six Stand 30"-2-High Continuous Roughing Slab and Billet Train and a Six Stand-2-High-21"-Continuous Finishing Sheet Bar Train, installed, 1930.

9-Motors-22,000 Main Drive Horsepower, Installed 1929-30.

2-Hot Metal Mixers-1-1200 and 1-450 Ton Installed, 1930.

1-Blast Furnace Stack "G", Remodeled, 1931.

Sparrows Point, Maryland

1-Blast Furnace, Stack "A" remodeled, 1928.

1-Blast Furnace Stack "F", rebuilt, 1928.

2-Lapweld Tube Mills completed, 1928.

1-Blast Furnace Stack "D", remodeled, 1928.

2-Motors-800-Main Drive Horsepower purchased in 1927 were installed, 1928.

1-Blast Furnace, Stack "B" remodeled, 1929.

8-Soaking Pits, installed, 1929.

1-Blast Furnace, Stack "C" remodeled 1930.

1-Electric Butt Weld Tube Mill completed, 1930.

2-Hot Metal Mixers, 1-1200-Ton, 1-450-Ton, installed 1930.

61-Koppers-Becker By-Product Coke Ovens, installed, 1930.

1-110,000 C. F. M. Turbo-Blower, installed, 1930.

4-30" Hot Sheet Mills completed, 1930.

1-Motor-2,000 Main Drive Horsepower purchased in 1929, installed, 1930.

2-Twin Gas Blowing Engines, installed, 1930.

6-150-Ton Basic Open Hearth Furnaces, installed, 1931.

1-40"-Reversing Slabbing Mill completed, 1931.

2-Motors, 9,500 Main Drive Horsepower, purchased 1929, installed, 1931.

1-160" Sheared Plate Mill completed, 1931.

1-Motor-4,500 Main Drive Horsepower, Installed, 1931.

1-18"-4-High Steckel Cold Mill, installed, 1931.

1-3-High Hot Sheet Mill, installed, 1933.

1-Blast Furnace, Stack "D" being remodeled, 1933.

1-8"-Bar Mill under construction, 1933.

Steelton, Pa.

1-Blast Furnace, Stack "B" remodeled, 1928.

Coke Wharf and Screening Station at Coke Plant, completed, 1928.

2-Waste Heat Boilers at Open Hearth Department, installed, 1928.

4-Gas Producers for Open Hearth Furnaces, installed, 1928.

1-Motor, 2,500 Main Drive Horsepower, installed, 1929.

New Scrap Preparation Plant built, 1930.

Blair Strip Steel Company

New Castle, Pa.

1-16"-2-Stand-Cold Strip Mill driven by 2-250-Horsepower Motors installed, 1929.

Bopp Steel Corporation

Detroit, Michigan

1-12"-Cold Strip Mill, installed, 1930.

1-18"-4-High Cold Strip Mill, installed, 1930.

E. G. Brooke Iron Company

Birdsboro, Pa.

1-Blast Furnace, Stack "Brooke", Remodeled, 1928.

Buffalo Steel Company

Tonawanda, New York

1-Motor-500-Main Drive Horsepower, installed, 1930.

A. M. Byers Company

Ambridge, Pa.

This plant involving the expenditure of approximately $10,000,000 was placed in operation in October, 1930, for making wrought iron by the Aston Process. The present capacity of 25,000 tons of wrought iron will be augmented in the future to permit producing 50,000 tons per month if desired. The major equipment in the plant is as follows:

3-15-Ton cupolas for Melting Iron.

2-60-Ton-Tilting Slag Melting Furnaces of Open Hearth Design.

2-10-Ton Bessemer Converters each equipped with a 25,000 C. F. M. Air Compressor for processing pig iron.

1-70-Ton Automatically Operated Electric Locomotive for Process Dept.

1-900-Ton Press for Forming Iron Ball into 17" x21" Ingot.

1-40"x110"-2-High Reversing Blooming Mill.

7-5-Door Producer Gas Fired Heating Furnaces.

1-46"-Universal Plate Mill.

1-20"-18"-16"-Merchant Mill consisting of 4-2-High Stands, 1-3-High Stand and 4-Edging Stands.

1-14"-9"-Merchant Mill consisting of 1-3-High-14"-Roughing Stand, 4-3-High-9"-Finishing Stands and 1-2-High-9" Finishing Stand.

8-Motors-18,300 Main Drive Horsepower.

2-500 Hp. Boilers.

5-Gas Producers.

10-Direct Current Motor Generator Sets, Capacity, 12,200 KW.

Calumet Steel Company

Chicago Heights, Ill.

1-18"-1 Stand Rerolling Mill installed 1930.

1-Motor, 2,000 Main Drive Horsepower, installed, 1930.

Canton Tin Plate Company

Canton, Ohio

1-8-Stand-Tin Mill with 36,000 Tons coke and black tin plate annual capacity started production, 1930.

1-28"-Hot Tin Mill, installed, 1933.

Carnegie Steel Company

The high tension electric power network of the

properties of the United States Steel Corporation in the Pittsburgh District was completed in 1928 by the addition of sub-stations, power houses and tie lines at the Carrie Furnaces, Rankin, Pa., Edgar Thomson Works, Braddock, Pa., and the Clairton By-Product Works of the Carnegie Steel Company and the National Works of the National Tube Company, McKeesport, Pa.

Carrie Furnaces, Rankin, Pa.

1-Blast Furnace Stack #1, remodeled, 1930.

1-Blast Furnace, Stack #2, remodeled, 1931.

Clairton, Pa.

Blast Furnaces Stacks #1 and #2 Remodeled and gas cleaning facilities installed, 1929.

4-125-Ton Ladle Cranes for Open Hearth Department, installed, 1929.

1-Battery of Coke Ovens Remodeled, 1930.

Coal Cleaning Equipment installed, 1931.

Duquesne, Pa.

Blast Furnace Stacks #2 and #3, rebuilt, 1928.

Blast Furnace Stacks Nos. 1, 4, 5 and 6, rebuilt, 1929.

Boiler Plant at Blast Furnaces completed, 1929.

2-Motors-2,850 Main Drive Horsepower, Installed 1930 to electrify 22" Bar Mill.

Scrap Preparation Plant, completed, 1932.

Edgar Thomson Works, Braddock, Pa.

4-Basic Open Hearth Furnaces rebuilt, 1928.

Blast Furnace Stack "I" rebuilt and equipped with new stoves and turbo-blower, 1929.

New Charging and Pouring Equipment installed at #4 Open Hearth Department, 1930.

Blast Furnace Stack "D" rebuilt, 1930.

Blast Furnace Stack "F" rebuilt, 1931.

An ore bridge to serve four blast furnaces with a capacity of 1,000 tons an hour with a bucket capacity of 17 tons per lift, a bridge speed of 175 feet per minute and a span of 190 feet equipped with ten direct current motors, controlled electro pneumatically was installed in 1931.

Farrell, Pa.

1-Motor-4,000 Main Drive Horsepower purchased in 1927, installed, 1928.

1-24"-Continuous Billet Mill, completed, 1928.

Open Hearth Furnaces Enlarged and heavier pouring equipment installed 1930.

Homestead, Pa.

New Ladle and Charging Cranes installed at #4 Open Hearth Plant, 1932.

McDonald, Ohio

9-Motors-5,600 Main Drive Horsepower, Installed, 1928.

1-10"-Hoop Mill Completed, 1929.

10-Motors-8,240 Main Drive Horsepower, Installed, 1930.

1-10"-Merchant Mill, Completed, 1931.

1-12"-Precision Rolling Machine to be installed, 1934.

Mingo Junction, Ohio

1-Motor-1,500 Main Drive Horsepower, Installed, 1929.

1-1,500 Ton Hot Metal Mixer installed, 1930.

2-110,000 C. F. M. Turbo-Blowers installed, 1930.

Blast Furnace Stack #2 rebuilt, 1930.

McKees Rocks, Pa.

Heat Treating Equipment installed in Wheel Mill, 1931.

Equipment to manufacture floor reinforcement, installed, 1931.

Ohio Works, Youngstown, Ohio

Blast Furnace Stack #2-Remodeled, 1928.

Skull cracker and stripping cranes installed in Open Hearth Department, 1930.

Carpenter Steel Company

Reading, Pa.

5,700 Main Drive Horsepower installed on rebuilt 12"-10"-9" and 20"-18"-16" 3-High Merchant Mills, 1929-30.

1-12"-Cold Strip Mill, completed, 1929.

2-6"-Cold Strip Mills, completed, 1929.

2-8"-Cold Strip Mills, completed, 1929.

1-Cluster Cold Strip Mill, completed, 1930.

1-1000 lb. Electric Melting Furnace, Installed, 1930.

1-New Electric Power substation with 2-1,000 Kw. Generators, installed, 1931.

1-Bell type electric furnace for bright annealing strip, installed, 1933.

1-12"-4-High Cold Strip Mill, completed, 1933.

Central Iron and Steel Company

Harrisburg, Pa.

Equipment installed at ten 126" plate mill heating furnaces to burn pulverized coal and 250 Horsepower boilers to utilize waste heat during 1928-29.

Universal Mill Shipping Facilities, Improved, 1929.

1-1250 Kw. Motor Generator Set Installed in new substation, 1929.

1-Coal Pulverizer installed, 1929.

1-300 ton-Hydraulic Press installed, 1929.

1-1800 foot pipe line to collect steam from all waste heat boilers on heating furnaces and open hearths, completed, 1929.

Boiler Water Conditioning apparatus installed, 1932.

2-Open Hearth Furnaces equipped with Combustion Control apparatus, 1932.

3-500 Horsepower Fire Tube Boilers utilizing waste heat from Open Hearth Furnaces, installed, 1932.

Chrome Steel Corporation

Carteret, New Jersey

1-12"-Merchant Mill completed, 1929.

Colorado Fuel and Iron Company

Pueblo, Colorado

31-Koppers-Becker By-Product Coke Ovens installed, 1930.

1-Blast Furnace, Stack "B", rebuilt, 1931.

1-Open Hearth Furnace increased to 75-Tons, 1932.

Rail Mill alterations completed, 1932.

Blast Furnace Stack "D" rebuilt and enlarged, 1932.

Ten Basic Open Hearth Furnaces rebuilt, 1933.

Blast Furnace, Stack "E" being rebuilt and equipped with electric clay gun, automatic stock control and new skip hoist, 1933.

Columbia Steel Corporation

Pittsburgh, California

2-150-Ton Basic Open Hearth Furnaces completed, 1928.

Machine Shop completed, 1928.

Facilities to manufacture wire netting installed, 1928.

1-24"-Billet Mill, completed, 1929.

8-28"-Hot Tin Mills completed, 1929.

5-28"-Cold Tin Mills, installed, 1929.

1-Jobbing Sheet Mill completed, 1929.

1-Merchant Mill completed, 1929.

Provo, Utah

23-Koppers Becker By-Product Coke Ovens installed, 1928.

Torrance, California

1-36"-Sheet Mill completed, 1928.

2-Motors 3,000 Main Drive Horsepower, purchased in 1927, were installed, 1928.

Continental Steel Corporation

Kokomo, Indiana

1-100-Ton Open Hearth Furnace, completed, 1928.

1-19"-6-Stand 2-High Continuous Sheet Bar and Billet Mill, driven by 1-Motor, 5,000 Horsepower (purchased in 1927) was completed in 1928.

Facilities for manufacture of chain fencing were installed, 1929.

A new sheet mill consisting of 6-29" Hot Sheet Mills and 2-26" Cold Sheet Mills and 4-galvanizing pots began operation 1929.

1-100-Ton Open Hearth Furnace, installed, 1929.

1-20"-Wire Rod Mill, rebuilt, 1929.

1-Motor, 1,500 Main Drive Horsepower, installed, 1929.

2-Wire Drawing Machines with a total of 11 Blocks were installed, 1933.

Three sheet mills were equipped with continuous pack and sheet furnaces and automatic roller and catcher tables, 1933.

Corrigan McKinney Steel Company

Cleveland, Ohio

1-32"-Reversing Blooming Mill, driven by a 5,000 Horsepower Motor, (purchased in 1929) was completed, 1930.

1-7-Hole Regenerative Soaking Pit, installed, 1930.

2-1,600 Kw. Motor Generator Sets, installed, 1930.

Crucible Steel Company of America

Jersey City, New Jersey

2-7½"-Steckel Cold Strip Mills, installed, 1930.

Syracuse, New York

2-Motors-800-Main Drive Horsepower, installed, 1930.

Pittsburgh, Pa.

1-Motor-400 Main Drive Horsepower, installed, 1929.

4-28"-Hot Sheet Mills, installed, 1930.

2-26"-Cold Sheet Mills, installed, 1930.

Davison Coke and Iron Company

Neville Island, Pa.

70-Koppers-Becker By-Product Coke Ovens with complete coal handling equipment, gas cleaning units and by-product recovery plant, installed, 1930.

1-Blast furnace stack, Neville Island remodeled, 1930.

2-Turbo Blowers for Blast furnace, installed, 1930.

1-7,000 Barrel cement plant, installed, 1930.

Boiler House with 2-Boilers to utilize waste heat from cement kiln.

Boiler House with 6-860 Horsepower Boilers to burn blast furnace and coke oven gas and 1-860 Horsepower Boiler to burn coke breeze, completed, 1930.

Electric Power station with two steam generators of 6,250 Kva. capacity each, completed, 1930.

Henry Disston & Sons, Inc.

Tacony, Philadelphia, Pa.

1-6-Ton Forge Hammer with new equipment, installed in Forge Shop, 1928.

Donner Hanna Coke Corporation
Buffalo, New York

1-800-Ton Blast Furnace Stack #1, completed, 1928.

51-Koppers-Becker By-Product Coke Ovens, completed, 1930.

Eastern Rolling Mill Company

Baltimore, Maryland

2-Galvanizing Pots, installed, 1930.

1-Motor-400-Main Drive Horsepower, purchased, 1933.

1-84″-4-High Cold Strip Mill, being constructed, 1934.

Empire Steel Corporation

Mansfield, Ohio

2-85-Ton Basic Open Hearth Furnaces, completed, 1929.

6-Sheet Normalizing Furnaces, installed, 1929.

5-Continuous Sheet Furnaces, installed, 1929.

2-Continuous Pack Furnaces, installed, 1931.

Waddell Works, Niles, Ohio

1-Motor-300-Main Drive Horsepower, installed, 1929.

Firth Sterling Steel Company

McKeesport, Pa.

1-10″-Cold Strip Mill, completed, 1929.

1-8″-Merchant Mill, completed, 1930.

2-Electric Melting Furnaces 1-½-ton, 1-1-ton, installed, 1930.

1-12″-Hot Mill, completed, 1931.

1-1-ton Electric Melting Furnace, installed, 1931.

Plant for manufacture of sintered carbide wire drawing dies, completed, 1931.

Follansbee Brothers Company

Follansbee, W. Va.

3-Motors, 3,500 Main Drive Horsepower were installed during 1929 to complete electrification of hot and cold mills, changing from 25 to 60 cycle frequency.

1-38″-4-High Steckel Cold Mill for the production of tin plate from coiled hot rolled strip, installed, 1933.

1-Motor-1,000 Main Drive Horsepower, purchased in 1932, installed, 1933.

Electro cleaning unit for cleaning tin plate, installed, 1933.

Toronto, Ohio

1-30″x66″-Hot Sheet Mill, completed, 1929.

Ford Motor Company

Detroit, Michigan

1-10″-Merchant Rod and Strip Mill, completed, 1928.

3-Motors-4,050 Main Drive Horsepower, purchased in 1927, installed, 1928.

3-100-Ton Basic Open Hearth Furnaces, installed, 1929.

2-1,400 Horsepower Boilers, installed, 1930.

1-110,000 KW. compound turbine generator, installed, 1930.

1-400-Ton Basic Open Hearth Furnace, installed, 1931.

2-600-Ton Hot Metal Mixers, installed, 1931.

1-Blast Furnace, Stack "Henry", remodeled, 1932.

Fretz Moon Tube Company

Butler, Pa.

1-Butt Weld Tube Mill, completed, 1932.

Globe Iron Company

Jackson, Ohio

1-Blast Furnace Stack 87′-6″x18′-blown in, 1929.

Globe Steel Tubes Company

Milwaukee, Wisconsin

5-Motors, 2,600 Main Drive Horsepower, installed, 1928.

1-Foren Tube Mill, driven by 7-Motors, 2,500 Main Drive Horsepower, installed, 1933.

Granite City Steel Company
Granite City, Illinois

1-Slab Heating Furnace for Plate Mills, installed, 1929.

New building to house all maintenance department shops, completed, 1929.

2-28"-Hot Tin Mills, completed, 1931.

Great Lakes Steel Corporation

Ecorse, Michigan

The Great Lakes Steel Corporation was formed in April, 1929. Construction of plant costing approximately $40,000,000, began May, 1929. November 7, 1929, the National Steel Corporation was formed with the Great Lakes Steel Corporation as a Division and the Hanna Furnace Company with pig iron capacity at Zug Island became a unit of Great Lakes Steel Corporation. In 1931 the National Steel Corporation acquired the Michigan Steel Corporation plant at Ecorse which is now the full finished sheet plant of the Great Lakes Steel Corporation.

The principal equipment installed during the past four years is as follows:

3-110-Ton Thermos Type Hot Metal Cars for delivering molten metal from the blast furnaces at Zug Island to Open Hearths.

8-16'x48'-150-Ton Basic Open Hearth Furnaces oil fired with a capacity of approximately 800,000 ingot tons annually.

75-Ton Ladles for pouring metal into charging side of Open Hearths.

1-125-Ton Ladle Crane on Charging Side of Open Hearth.

2-7-Ton Charging Cranes for scrap and limestone.

1-70-Ton Oil-Electric Locomotive for Open Hearth Charging side.

8-Boilers for Utilizing Waste Heat from Open Hearth Furnaces.

2-Oil Fired Auxiliary Boilers in Open Hearth Department.

600,000 Gallon Oil-Storage Plant.

175-Ton Ladles Used on Pouring Side of Open Hearth Furnaces.

2-250-Ton-Ladle Cranes on Pouring Side of Open Hearth Furnaces.

1-200-Ton Ingot Stripper.

4-4-Hole-6-Ingot Producer Gas Fired Soaking Pits.

2-7½-Ton Soaking Pit Cranes.

3-Gas Producers.

1-40"-Reversing Blooming Mill, driven by a 7,000 Horsepower D. C. Motor.

1-800-Ton Slab Shear.

1-350-Ton Crop Shear.

1-21"-Billet and Sheet Bar Mill consisting of 9-Stands of 2-High and 2-Stands vertical Edging Rolls, driven by 5-Motors, 13,250 HP.

4-Continuous Oil Fired Heating Furnaces for Strip Mill and Merchant Mills.

1-32"-Continuous Strip Mill consisting of 4-2-High Stands, 3-Stands of vertical edgers and 6-4-High Stands, driven by 13-Motors, 20,650 Horsepower.

1-14"-Merchant Mill driven by 10-Motors, 6,900 Horsepower.

1-10"Merchant Mill consisting of 11-2-High Stands and 2-3-High Stands, driven by 9-Motors, 5,650 Horsepower.

1-4-Arm Steam Driven Pickling Machine.

1-Normalizing Furnace.

4-Synchronous Motor Generator Sets to supply 24,000 KW.

1-30,000 Kva. Sub-station to step down power from 24,000 volts to 6,900 volts.

400-Mill Type Motors for Cranes and Mill Auxiliaries.

2-Motors, 3,000 Main Drive Horsepower, installed in Sheet Mills, 1930.

1-3-High Hot Sheet Mill, installed, 1933.

Blast Furnace, Stack "B" remodeled, 1933.

Gulf States Steel Company

Alabama City, Alabama

1-Blast Furnace, Stack "Alabama City", remodeled, 1928.

3-Motors, 1,350 Main Drive Horsepower, installed on wire blocks, 1928.

Garrett Rod Mill of 18-Stands electrified, 6-Motors-10,850 Main Drive Horsepower and 1-1000-Kw. Motor Generator set, installed, 1928.

3-75-Ton Basic Open Hearth Furnaces rebuilt and increased to 90-Ton capacity, 1930.

1-40" Blooming Mill, driven by 1-Motor, 7,000 Horsepower, completed, 1930.

2-4-Hole ten-ingot-Soaking pits with combustion control apparatus, completed, 1929.

2-Slab Heating Furnaces for Universal Mill, completed, 1930.

1-32"-3-High Universal Plate Mill driven by 1-Motor, 4,000 Horsepower, installed, 1930.

2-Plate Shears for Finishing Universal Plates, installed, 1930.

A new sheet department consisting of 3-3-High, 3-2-high Sheet Mills and 1-3-High Jobbing Sheet Mill, completed, 1930.

1-Motor-1,500 Main Drive Horsepower, installed, 1930.

Hamilton Coke and Iron Company

Hamilton, Ohio

1-Blast Furnace Stack, rebuilt, 1928.

45-Koppers-Becker By-Product Coke Ovens, installed, 1928.

1-150-Ton Sintering Machine, installed, 1929.

Harrisburg Pipe and Pipe Bending Company

Harrisburg, Pa.

1-750-Ton Hydraulic Press, with 300 gallon per minute, 1800 Lb. pressure pump, installed, 1930.

Heppenstall Company

Pittsburgh, Pa.

2-600 lb. Electric Melting Furnaces, installed, 1928.

2-Acid Open Hearth furnaces increased from 18- to 25 tons capacity, 1929.

Annealing Equipment, installed, 1929.

1-8″-2-Stand Cold Strip Mill, completed, 1932.

1-10″-Hot Strip Mill, completed, 1932.

1-Electric Inductor for annealing, installed, 1932.

Highland Iron and Steel Company

Terre Haute, Ind.

1-10″-Bar Mill, completed, 1928.

1-8″-Merchant Mill for wrought iron, completed, 1929.

Illinois Steel Company

Gary, Indiana

Four Hot Blast Stoves at #11 Blast Furnace, completed, 1928.

1-Blast Furnace Stack #11, remodeled, 1928.

1-Blast Furnace Stack #10, remodeled, 1929.

Equipment for coiling, shearing, and cooling hot strip at 20″ and 12″ mills, installed, 1929.

Blast Furnace Stack #8, remodeled, 1930.

1-28″-Continuous Hot Strip Mill, completed, 1930.

10-Motors, 19,850 Main Drive Horsepower, purchased in 1929, were installed on 28″ Continuous Hot Strip Mill, 1930.

1-600-Ton Hot Metal Mixer, installed, 1930.

7-150-Ton Basic Open Hearth Furnaces, completed, 1931.

8-150-Ton Hot Metal Mixers for molten pig iron, installed, 1931.

1-44″-Blooming Mill, completed in 1931.

1-Motor, 8,000 Main Drive Horsepower, purchased in 1930, installed on 44″-Blooming Mill, and 1-Motor, 400 Main Drive Horsepower on 44″ Blooming Mill edger, 1931.

1-Motor-300 Main Drive Horsepower, installed, 1931.

Pickling Equipment, installed for strip steel products, 1931.

Heat Treating Department in wheel mills, completed, 1931.

1-Sintering Machine, installed, 1931.

2-Batteries of 138 Koppers-Becker By-Product Coke Ovens, installed, 1932.

Joliet, Illinois

Blast Furnace Stack #3, reconditioned, stoves enlarged, 1929.

By-Product Plant at Coke Department, improved, 1929.

1-Sintering Plant for Blast Furnaces, installed, 1930.

South Chicago, Ill.

10-Basic Open Hearth Furnaces at #2 Open Hearth Plant enlarged and Equipped with modern auxiliary facilities, 1928.

1-Blast Furnace Stack #2, rebuilt, 1928.

1-Blast Furnace, Stack #10, remodeled, 1928.

8-Hot Blast Stoves for Blast Furnace Stacks #5 and #6, remodeled, 1929.

1-1300-Ton Hot Metal Mixer installed at Open Hearth Furnaces, 1929.

The #1-Power Station was enlarged and 2-6,000 Kw. gas engine driven generators, installed, 1929.

The following mills all steam driven were electrified by the application of 3-Motors, 16,500 Main Drive Horsepower (purchased in 1928) during, 1929.

1-40″-Reversing Blooming Mill, 1-7000 Horsepower Motor.

1-32″-Reversing Structural Roughing Mill, 1-3,500 Horsepower Motor.

1-28″-Structural Finishing Mill, 1-6,000 Horsepower Motor.

Blast Furnace Stack #8, rebuilt, 1930.

Consolidation of all roll turning into new roll shop, 1930.

Three motor-driven centrifugal compressors for furnishing air to Bessemer Converters, each with a capacity of 36,000 C. F. M. at 27 lbs. pressure were installed 1930.

Blast Furnace Stack #4, remodeled, 1931.

Six Gas Engine Driven Blowing Units for Blast Furnaces, installed, 1931.

14-150-Ton Basic Open Hearth Furnaces, completed, 1931.

1-44"-Blooming Slabbing Mill driven by two 5,000 Horsepower Motors, (1 motor on both top and bottom roll) and 1-2,500 Horsepower Motor on Vertical Edger, installed, 1931.

1-10" Alloy Bar Mill driven by 8-Motors, 7,150 Main Drive Horsepower, (purchased in 1930) completed, 1931.

1-Wide Flange Beam Mill consisting of 1-54" Reversing Blooming Mill, 1-52"-Reversing Roughing Structural Stand, 1-52" Reversing Intermediate Structural Stand and 1-52" Finishing Structural Stand, driven by 7-Motors, 30,000 Main Drive Horsepower, completed, 1931.

The largest plate strip mill in the country consisting of 1-stand of scale breaking rolls, 3-stands of 2-high roughing rolls, 2 vertical edging stands and 6-stands of 4-high finishing rolls capable of rolling plate strip 92" wide, 140 feet long at a speed of 700 feet per minute, driven by 10-Motors, 26,800 Main Drive Horsepower, completed, 1931.

1-20,000 Kw. Generating Station, completed, 1931.

1-Sinter Machine installed at Blast Furnaces, 1931.

2-Electric Furnaces and Auxiliary equipment for manufacture of stainless steel, installed, 1932.

Inland Steel Company

Indiana Harbor, Indiana

1-150-Ton Basic Open Hearth Furnace, completed, 1929.

74-Koppers-Becker By-Product Coke Ovens, completed, 1929.

1-Coke Oven Gas Fired Billet Heating Furnace for 10" Merchant Mill, completed, 1929.

1-10"-Continuous Merchant Mill consisting of 12 2-High-10" Horizontal Stands and 3-3-High-10" Vertical Stands, driven by 12-Motors, 7,000 Main Drive Horsepower, completed, 1930.

1-Sintering Plant for Blast Furnaces, installed, 1930.

1-Continuous Hot Strip Mill consisting of 10-4-High 29"x49"x76" Stands and 2-2-High Scale Breaker Stands, driven by 12-Motors, 34,500 Main Drive Horsepower, completed, 1932.

1-Cold Strip Mill consisting of 3-Tandem Stands 4-High, 20"x44"x54", driven by 3-Motors, 1,500 Main Drive Horsepower, completed, 1932.

1-Cold Strip Mill consisting of 3-Tandem Stands 4-High, 20"x44"x42", driven by 3-Motors, 1,050 Main Drive Horsepower, completed, 1932.

2-Cold Strip Mills each consisting of 1-20"x44"x 72"-4-High Stands, each driven by 1-Motor, 500 Main Drive Horsepower, completed, 1932.

2-Skin Rolling Mills each consisting of 1-27"x54" 2-High Stand, completed, 1932.

The finishing department of the Strip Mill was completed by the addition of two box annealing furnaces, two continuous pickling machines, eight batch annealing furnaces, flatteners, levelers, side trimming shears and slitters during 1933.

1-Steckel type 5"x34"x38" Cold Mill for producing tin plate gages from hot rolled coiled strip, driven by 1-Motor, 1,000 Main Drive Horsepower, installed, 1933.

18-Tinning Machines, installed, 1933.

1-Tandem Cold Mill for rolling tin plate from hot rolled coiled strip consisting of 5-Tandem Stands of 18"x49"x42" 4-High, driven by 5-Motors, 3,250 Main Drive Horsepower and 2-Single Stands of 18"x39"x 42" 4-High, will be placed in operation during 1934.

Interlake Iron Company

Duluth, Minnesota

41-Koppers-Becker By-Product Coke Ovens, completed, 1928.

Erie, Pa.

Blast Furnace Stack "Perry", remodeled, 1928.

South Chicago, Illinois

1-Blast Furnace Stack "B", remodeled, 1928.

3-Turbo-Blowers to deliver 220,000 CFM. at 22# pressure, installed, 1930.

Ore Dock and Ore Bridge, completed, 1930.

Blast Furnace Stack #1, remodeled, 1931.

Toledo, Ohio

Blast Furnace Stack "A", rebuilt, 1928.

International Harvester Company

South Chicago, Illinois

2-100-Ton Basic Open Hearth Furnaces, completed, 1928.

1-Blast Furnace Stack #3 with a capacity of 1,000 tons per day, completed, 1929.

Extensive campaign made on Open Hearth Furnaces using mixed gas (blast furnace and coke oven) during 1929-30.

Blast Furnace Stack "A", remodeled, 1930.

45-Koppers-Becker By-Product Coke Ovens, completed, 1930.

2-100-Ton Basic Open Hearth Furnaces equipped with automatic open hearth combustion control, 1930.

Jackson Iron and Steel Company

Jackson, Ohio

1-Blast Furnace Stack re-lined, 1928.

1-Single Strand Pig Casting Machine, installed, 1929.

Jones & Laughlin Steel Corporation

Aliquippa, Pa.

1-30"-2-High-1-Stand round mill for seamless tube billets, driven by 1-Motor, 3,000 Main Drive Horsepower, (purchased in 1927) completed, 1928.

1-Seamless Tube Mill for making tubes up to 13" in diameter, driven by 12-Motors, 13,400 Main Drive Horsepower, (purchased in 1927-28) completed in 1928.

8-Soaking Pits, installed, 1928.

1-Blast Furnace Stack "Aliquippa", remodeled, 1928.

1-Blast Furnace Stack #4, remodeled and enlarged, 1929.

1-90,000 C.F.M. Turbo-Blower, installed, 1930.

1-20,000 Kw. Turbo-Generator, installed, 1930.

3-Water Tube-Boilers, installed in Blast Furnace Boiler House, 1930.

1-Normalizing Furnace, installed at tin mills, 1931.

81-Koppers-Becker By-Product Coke Ovens, completed, 1931.

1-Motor-300-Main Drive Horsepower, installed, 1931.

Continuous Pack and Pair Furnaces with roller and catchers tables, installed in tin mills, 1931.

1-Push bench for manufacture of seamless tubes, driven by 1-Motor, 1,500 Main Drive Horsepower, installed, 1932.

1-16"x53"x42"-4-High Reversing Cold Mill for rolling tin plate gage from hot rolled coiled strip, driven by three motors 3,100 Main Drive Horsepower, installed, 1933.

Pittsburgh, Pa., North Works

1-20,000 Kw. Turbo-Generator, installed, 1929.

5-Water Tube Gas Fired Boilers, 12,000 Hp, with auxiliary equipment, installed, 1931.

1-14"-9-Stand Continuous Merchant Mill, driven by 6-Motors, 7,350 Main Drive Horsepower, (purchased in 1930) installed, 1931.

South Side Works

Equipment to manufacture 20,000 tons steel piling annually, installed, 1928.

2-25-Ton Bessemer Converters, installed, 1930.

2-Turbo-Blowers for Converters, installed, 1930.

Keystone Steel and Wire Company

Peoria, Illinois

Open Hearth Department enlarged by addition of heavier pouring equipment on tapping side, 1929.

2-Stands added to 10" Continuous Wire Rod Mill and driven by 1-Motor, 500 Main Drive Horsepower, (purchased in 1928) during 1929.

Kilby Car and Manufacturing Company

Anniston, Alabama

1-Motor-600 Main Drive Horsepower added to 18" Breakdown Mill, 1928.

1-Motor-750 Main Drive Horsepower added to 10" 3-High 4-Stand Bar Mill, 1929.

Knoxville Iron Company

Knoxville, Tennessee

1-Motor-1,000 Main Drive Horsepower, installed, 1929.

Laclede Steel Company

Alton, Illinois

2-Motors-1,150 Main Drive Horsepower, installed, 1928.

1-100-Ton Basic Open Hearth Furnace, completed, 1929.

Laclede Tube Company

Alton, Illinois

1-Buttweld Tube Mill with galvanizing equipment to produce 40,000 tons black and galvanized pipe annually, installed, 1929.

Latrobe Electric Steel Company

Latrobe, Pa.

1-12"-3-High 5-Stand Bar Mill, driven by 1-Motor, 700 Main Drive Horsepower, installed, 1929.

Ludlum Steel Company

Watervliet, New York

Heating Furnace for 9" Merchant Mill, installed, 1929.

Heat Treating Department with furnaces, installed, 1929.

Plant for manufacture of "Strauss Metal", completed, 1929.

1-¾-Ton Experimental Electric Furnace, installed, 1929.

1-1-Ton Electric Furnace, installed, 1933.

Mercer Tube Company

Sharon, Pa.

1-Butt Weld Tube Mill, completed, 1933.

Michigan Seamless Tube Company

South Lyon, Michigan

1-Motor-300-Main Drive Horsepower, installed, 1930.

Missouri Rolling Mill Company

St. Louis, Missouri

1-Motor, 500 Main Drive Horsepower, installed, 1933.

National Tube Company

Ellwood City, Pa.

Draw Benches for manufacture of Seamless Tube Mills, remodeled, 1931.

2-Motors, 3,900 Main Drive Horsepower, installed, 1931.

1-Seamless Tube Mill, completed, 1933.

Gary, Indiana

1-Tube Expander for Seamless Tube Mill, completed, 1928.

2-Motors-3,000 Main Drive Horsepower, installed, 1928.

1-Motor-600 Main Drive Horsepower, installed, 1929.

1-Mill for production of Seamless Tubes (#2 Seamless), driven by 6-Motors, 6,050 Main Drive Horsepower, installed, 1930.

Lorain, Ohio

1-32"-2-High-1-Stand Bar Mill, driven by 1-Motor, 3,000 Main Drive Horsepower, completed in 1928.

1-Seamless Tube Mill, driven by 5-Motors-8,300 Main Drive Horsepower, (purchased in 1927) completed in 1928.

Blast Furnace Stack #1, rebuilt, 1929.

Blast Furnace Stack #5, rebuilt, 1929.

1-Seamless Tube Mill, driven by 4-Motors-9,100 Main Drive Horsepower, (purchased in 1929) completed, 1930.

Skelp, Seamless, Butt and Lap Weld Heating Furnaces were equipped with burners for natural gas, 1932.

McKeesport, Pa.

Blast Furnace Stack #2, rebuilt, 1928.

1-13"-4-High 6-Stand Continuous Skelp Mill, driven by 6-Motors-6,600 Main Drive Horsepower, (purchased in 1928) completed, 1929.

Blast Furnace Stack #1, rebuilt, 1929.

1-32"-2-High 1-Stand Reversing Bar Mill, driven by 1-Motor-3,000 Main Drive Horsepower, (purchased in 1929) completed in 1930.

A new plant to weld pipe by the electric arc method 14" to 30" outside diameters in 40 foot lengths began initial operations, 1930.

2-Seamless Tube Mills, driven by 13-Motors-19,850 Main Drive Horsepower, (purchased in 1929-30) completed, 1930.

3-25-Ton Bessemer Converters, installed, 1930.

2-800-Ton Hot Metal Mixers for Duplexing Open Hearth and Bessemer Steel, installed, 1930.

3-250-Ton Basic Open Hearth Furnaces, completed, 1930.

Newton Steel Company

Monroe, Michigan

Plant for manufacture of black sheets 200,000 tons annual capacity consisting of 10 Sheet and 14 Pair Furnaces, 20 Hot Sheet Mills, driven by 2-Motors, 4,000 Main Drive Horsepower, (purchased in 1929); 18 stands of 26" cold rolls, driven by 4-Motors, 2,000 Main Drive Horsepower, (purchased in 1929); 2-Continuous Pickling Machines and 50-Box Annealing Furnaces began initial operations during 1930.

Newton Falls, Ohio

3-Motors, 1,200 Main Drive Horsepower, installed, 1928.

Otis Steel Company

Cleveland, Ohio

3-125-Ton Basic Open Hearth Furnaces, completed, 1928.

12-Cold Sheet Mills, 82"-2-Stands, 72"-1-Stand, 60"-5-Stands, and 54"-4-Stands, completed, 1929.

1-Soaking Pit, installed, 1930.

Blast Furnace Stacks #1 and #2, rebuilt, 1930.

1-Continuous Slab Heating Furnace, installed, 1931.

1-72"-Continuous Hot Strip Mill consisting of 1 Scale Breaker, 2-2-High Stands, 1-3-High Stand, 5 4-High Stands and 4-Edging Stands, driven by 10 Motors, 24,100 Main Drive Horsepower, (purchased in 1931) completed, 1932.

1-72"-4-High Cold Strip Mill consisting of 2-20½" x52"x72" Stands in Tandem, driven by 3-Motors, 4,900 Main Drive Horsepower, purchased in 1931, completed, 1932.

Pacific Coast Steel Company

San Francisco, California

Plant for manufacture of Bolts, completed, 1929.

Phoenix Manufacturing Company

Joliet, Illinois

4-Motors-1,700 Main Drive Horsepower were placed on 16" Bar Mill and 8" Guide Mill, 1928.

Pittsburgh Crucible Steel Company

Midland, Pa.

1-40"-2-High 1-Stand Blooming Mill, completed, 1931.

Pittsburgh Steel Company

Monessen, Pa.

Blast Furnace Stack #2, rebuilt, 1929.

2-Motors-3,600 Main Drive Horsepower, installed on 18"-2-High 6-Stand Continuous Bar Mill, 1928-29.

Allenport, Pa.

2-Motors-3,800 Main Drive Horsepower, installed on Piercing Mills, 1928.

1-Seamless Tube Mill, under construction, 1934.

Pittsburgh Tube Company

Monaca, Pa.

1-Butt Weld Tube Mill, installed, 1930.

Republic Steel Corporation

Buffalo, New York

Blast Furnace Stack #1, rebuilt, 1928.

1-25-Ton Electric Furnace, installed, 1928.

Facilities in Cold Drawing Department increased to permit output of 18,000 tons of cold drawn bars annually, 1928.

1-Ingot Stripper, installed, 1930.

Blast Furnace Stack #1, rebuilt, 1933.

Canton, Ohio

15-Koppers-Becker By-Product Coke Ovens, completed, 1929.

1-25-Ton Electric Furnace, installed, 1930.

1-Walking Beam Heating Furnace, installed, 1930.

1-30"x56"x58"-3-High Hot Sheet Mill, completed, 1930.

1-12"-Merchant Mill, rebuilt, 1932.

1-25-Ton Electric Furnace, installed, 1933.

1-Motor-500 Main Drive Horsepower, installed, 1933.

Chicago, Illinois

1-21"-2-High 2-Stand Billet Mill, driven by 1-Motor, 6,000 Main Drive Horsepower, completed, 1928.

1-100-Ton Basic Open Hearth Furnace, completed, 1928.

1-100-Ton Basic Open Hearth Furnace, completed, 1929.

1-10"-2-High 19-Stand Merchant Mill, driven by 9-Motors, 10,000 Main Drive Horsepower, (purchased in 1928-29-30) completed, 1930.

1-Ingot Car for use at Soaking Pits, installed, 1930.

Cleveland, Ohio

1-Motor-1,000 Main Drive Horsepower, installed on 10"-3-High 2-Stand and 10"-2-High 2-Stand Merchant Mill, 1928.

1-4-Hole Soaking Pit, installed, 1929.

Massillon, Ohio

1-25-Ton Electric Arc Furnace, installed, 1930.

8-Pack and 5-Pair Furnaces, installed in sheet mills, 1930.

1-9½"x24"x20"-4-High Cold Strip Mill, installed, 1930.

3-Motors-900-Main Drive Horsepower, installed, 1931.

1-4-High Cold Strip Mill, completed, 1932.

Pittsburgh, Pa.

1-Forming Mill, driven by 1-Motor-500 Main Drive Horsepower (purchased in 1929) completed, 1930.

Thomas, Ala.

Blast Furnace Stack #2, rebuilt, 1928.

Blast Furnace Stack #1, rebuilt, 1929.

Blast Furnace stack, equipped with revolving distributor, 1933.

Warren, Ohio

1-Blast Furnace Stack "Trumbull-Cliffs", remodeled, 1928.

1-14"x32"x24"-4-High 1-Stand Cold Mill, driven by 1-Motor-400-Main Drive Horsepower (purchased in 1927), completed in 1928.

1-14"x32"x24"-4-High 3-Stand Tandem Cold Mill, driven by 3-Motors, 1,200 Main Drive Horsepower, (purchased in 1927), completed in 1928.

2-2-High 20"-Single Stand Cold Mills, installed, 1928.

1-18"-4-High-Steckel Type Cold Mill, installed, 1928.

1-Disintegrator for Blast Furnace, installed, 1930.

1-125-Ton Hot Metal Mixer, installed, 1930.

6-Box Annealing Furnaces, installed, 1930.

1-10-Ton Soaking Pit Crane, installed, 1930.

1-110,000 CFM Turbo Blower for Blast Furnace, installed, 1933.

1-38"-4-High 1-Stand Cold Mill for the production of Tin Plate from Hot Rolled Coiled Strip, driven by three motors, 2,000-Main Drive Horsepower, to be completed during 1934.

Youngstown, Ohio

Spike Factory with an annual capacity of 46,000 kegs of spikes, completed, 1928.

1-10"-Edging Stand added to Continuous Sheet Bar and Skelp Mill, 1929.

3-275-Ton Ladle Cranes, installed, 1930.

11-Basic Open Hearth Furnaces, enlarged, 1930.

Remodeling of Mixer Plant at Bessemer Department, completed, 1930.

3-Continuous Gas Fired Heating Furnaces for 84"-3-High Plate Mill in Open Hearth Steel Works, installed, 1930.

3-Mills for the production of Tubes by the Electric Welding Method up to 16" in diameter, began operations, 1930.

Blast Furnace Stack #2, remodeled, 1933.

John A. Roebling & Sons Company

Roebling, New Jersey

Wire Galvanizing Equipment and Tension Measuring Equipment, installed, 1928.

2-4-Hole producer gas fired Soaking Pits, installed, 1929.

1-18"2-High 4-Stand Billet Mill, driven by 1-Motor-2,000 Main Drive Horsepower (purchased in 1928), completed, 1929.

1-14"-12"-9"-20-Stand Continuous Rod Mill, driven by 4-Motors, 4,700 Main Drive Horsepower (purchased in 1928), completed, 1929.

3-Motors, 1,650 Main Drive Horsepower, purchased in 1929-30 to complete electrification of wire drawing equipment.

Trenton, New Jersey

New Equipment in plant for manufacture of Tinned Steel Wire, installed, 1928.

St. Louis Gas and Coke Corporation

St. Louis, Missouri

1-Blast Furnace "Stack A", remodeled, 1928.

St. Louis Screw and Bolt Company

St. Louis, Missouri

1-40-Ton Basic Open Hearth Furnace, completed, 1930.

1-10" Bar Mill, completed, 1931.

Scullin Steel Company

St. Louis, Missouri

1-14"-3-High-1-Stand Bar Mill, completed, 1928.

1-12"-2-High 1-Stand Bar Mill, completed, 1928.

1-8"-2-High 1-Stand Bar Mill, completed, 1928.

1-Motor-800-Main Drive Horsepower, installed, 1928.

1-Plant for manufacture of 7,500 tons annually of railroad spikes, completed, 1928.

Rotary Electric Steel Company

Detroit, Michigan

Plant for manufacture of merchant bars, principal equipment consisting of 1-50-Ton Electric Melting Furnace, 7-10' diameter mold tables, 1-18"-Breakdown Mill driven by 1-Motor, 500 Main Drive Horsepower and 1-12"-Merchant Mill driven by 1-Motor, 800 Main Drive Horsepower, installed, 1933.

Sharon Steel Hoop Company

Sharon, Pa.

1-10½"x21"x26"-4-Stand Cluster Cold Strip Mill, installed, 1928.

1-8½"x17"x18"-3-Stand Cluster Cold Strip Mill, installed, 1928.

1-8½"x17"x26"-1-Stand Cluster Strip Mill, installed, 1928.

1-18"-2-High Cold Strip Mill, installed, 1928.

2-13½"-2-High Cold Strip Mills, installed, 1928.

5-10½"-2-High Cold Strip Mills, installed, 1928.

2-8½"-2-High Cold Strip Mills, installed, 1928.

2-10"-2-High Cold Strip Mills, installed, 1928.

1-Continuous Hot Strip Mill consisting of 18"-2-High 5-Stands and 14"-2-High 6-Stands, driven by 7-Motors-12,000 Main Drive Horsepower (purchased in 1928), completed, 1929.

4-20"-4-High Stands replace 6-14"-2-High Stands on Continuous Merchant Mill, 1932.

Sheffield Steel Corporation

Kansas City, Missouri

1-100-Ton Basic Open Hearth Furnace, completed, 1929.

1-24"-2-High 1-Stand Tie Plate Mill, completed, 1929.

1-18"-2-High 4-Stand Continuous Billet Mill, driven by 1-Motor, 2,500 Main Drive Horsepower, (purchased in 1928) completed, 1929.

1-Merchant and Rod Mill consisting of 1-14"-2-High 4-Stand Continuous Train; 1-12"-2-High 3-Stand Continuous Train, and 1-10"-2-High 10-Stand Continuous Train, driven by 5-Motors, 7,500 Main Drive Horsepower, (purchased in 1928-29) completed, 1929.

Wire Nail and Fence Department consisting of 52 Wire Blocks, 55 Nail Machines, 15 Barbed Wire Machines, 5 Wire Fence Machines and 1 Galvanizing Pan, completed, 1929.

1-10"-3-High 6-Stand Bar Mill (formerly in plant of Cleveland Hardware Company), driven by 1-Motor, 500 Main Drive Horsepower, completed, 1929.

1-Motor, 1,250 Main Drive Horsepower, purchased in 1933.

Sloss Sheffield Steel Corporation

Birmingham, Alabama

Blast Furnace Stack #1, remodeled, 1928.

Spang-Chalfant Company

Ambridge, Pa.

2-Motors, 1,200 Main Drive Horsepower, installed, 1928.

1-Electric Weld Tube Mill, installed, 1932.

Steel and Tubes, Inc.

Elyria, Ohio

3-Stands of 12" Cold Strip Mills, installed, 1929.

Superior Steel Corporation

Carnegie, Pa.

6-Motors, 6,800 Main Drive Horsepower, installed, 1928.

1-Tandem Cold Strip Mill consisting of 3-Stands of 5"x18"x18"-4-High Rolls, installed, 1929.

2-Motors, 600 Main Drive Horsepower, installed, 1929.

Sweets Steel Company

Williamsport, Pa.

1-Motor, 800 Main Drive Horsepower, installed, 1929.

Tennessee Coal Iron and Railroad Company

Ensley, Alabama

1-Blast Furnace Stack #5, rebuilt, 1929.

1-Blast Furnace Stack #6, rebuilt, 1930.

1-Blast Furnace Stack #7, rebuilt, 1930.

1-114'x26' Hot Blast Stove for Blast Furnaces, installed, 1930.

2-1,250 Horsepower Boilers, installed at Blast Furnace Power Plant, 1930.

1-110,000 C.F.M. Turbo-Blower, installed at Blast Furnaces. 1930.

5-Ladle Cranes in Open Hearth Department, remodeled, 1930.

Coke Works, Fairfield, Alabama

63-Koppers-Becker By-Product Coke Ovens, installed, 1928.

Fairfield Steel Works

Fairfield, Alabama

2-Blast Furnaces having 8-100'x26' Hot Blast Stoves, and 1-Double Strand Pig Casting Machine, completed, 1928.

Blast Furnace Power Plant with 5-Powdered Coal Fired Water Tube Boilers, rated 7,500 Boiler Horsepower; 3-Turbo-Blowers, each with a capacity of 75,000 C.F.M. at 30# pressure; 2-20,000 KW. Turbo-Generators; 2-750 KW. Motor-Generator Sets; 1-25,000 Kva. Outdoor Sub-Station, with Coal Pulverizing Plant; Water Treating Plant, Cooling Towers, and modern buildings to house Boilers and Turbo-Blowers and Generators, completed, 1928.

1-Continuous Hoop and Cotton Tie Mill, consisting of 1-12", 2-High, 12-Stand Train, with 14"-2-High Vertical Edgers, driven by 9-Motors, 5,500 Main Drive Horsepower, (purchased in 1928) completed, 1929.

The Sheet Mill Division of the Fairfield Works has been enlarged by converting the jobbing mill into sheet mills, additional sheet and pair furnaces, roughing and finishing sheet mills, roller and catchers tables, cold rolls, box and blue annealing furnaces, continuous pickling machines and galvanizing pots, during the past six years.

1-42"-Universal Plate Strip Mill, driven by 1-Motor, 4,000 Main Drive Horsepower, completed, 1931.

4-Motors, 4,000 Main Drive Horsepower, purchased, 1929-30.

1-150-Ton Basic Open Hearth Furnace, completed, 1931.

Thomas Steel Company

Warren, Ohio

Electro Galvanizing Equipment, installed, 1928.

1-4½"x16"x12"-1-Stand 4-High Cold Strip Mill, completed, 1930.

1-7"x19"x24"-1-Stand 4-High Cold Strip Mill, completed, 1930.

1-16"x24"-2-High Cold Strip Mill, completed, 1930.

1-10"x16"-2-High Cold Strip Mill, completed, 1930.

1-4½"x16"x12"-2-Stand 4-High Cold Strip Mill, completed, 1930.

1-20"-4-High Steckel Cold Strip Mill, installed, 1933.

Timken Steel and Tube Company

Canton, Ohio

3-100-Ton Basic Open Hearth Furnaces, completed, 1927-28.

5-Electric Furnaces, 1-7-Ton, 2-20-Ton, 1-100-Ton, installed, 1928-29.

1-22"-3-High 4-Stand Billet and Bar Mill, driven by 1-Motor, 2,000 Main Drive Horsepower, installed, 1928.

1-28"-3-High 2-Stand Billet and Bar Mill, completed, 1928.

1-16"x12"x10"-2-High 16-Stand Merchant Mill, completed, 1928.

4-Motors, 4,100 Main Drive Horsepower, installed, 1928.

Plant for manufacture of seamless tubes 3¼" to 10" O.D. with 1-Continuous Billet Heating Furnace, 1-Tube Reheating Furnace, 5-Pointing and Forging Furnaces, 1-36" Piercing Mill, 1-10-Stand Reducing Mill, 1-5-Stand Sizing Mill, Draw Benches, Forging Presses, Hammers and Annealing Furnaces to produce 80,000 tons annually began operations in 1930.

9-Motors, 10,900 Main Drive Horsepower, installed, 1928-29-30.

Tulsa Rolling Mills Company

Sand Springs, Oklahoma

Plant to produce 45,000 tons of merchant and concrete bars annually with the following equipment: 1-100-Ton Basic Open Hearth Furnace, 2-Continuous Oil Fired Heating Furnaces, 24"-3-High 1-Stand Blooming Mill, 16"-3-High 1-Stand Billet Mill, driven by 1-Motor, 1,200 Main Drive Horsepower, 10"-3-High 5-Stand Guide Mill, began initial operations, 1929.

Universal Steel Company

Bridgeville, Pa.

1-10"-3-High 4-Stand Bar Mill, completed, 1929.
1-20"-4-High Steckel Cold Strip Mill, completed, 1933.

Vulcan Crucible Steel Company

Aliquippa, Pa.

1-Motor, 400 Main Drive Horsepower, installed on Merchant Mill, 1928.

Washburn Wire Company

Phillipsdale, Rhode Island

1-Continuous Oil Fired Heating Furnace, installed, 1930.

2-Mills Stands, 1-15"-3-High 1-Stand and 1-15" 2-High 1-Stand placed on Garrett Rod Mill, 1930.

Weirton Steel Company

Clarksburg, W. Va.

The Tin Mill Drives were electrified, 1-Motor, 2,000 Main Drive Horsepower on 8-Stands and 1-Motor, 1,000 Main Drive Horsepower on 4-Stands in 1930.

Weirton, W. Va.

1-Cold Strip Mill consisting of 1-Tandem Train of 14"x32"x48"-4-High 4-Stands, 25"x44"-2-High 1-Stand, 1-Tandem Train of 14"x32"x42"-4-High 4-Stands, 25"x44"-2-High 1-Stand and 25"x44"-2-High 3-Stands, driven by 10-Motors, 5,000 Main Drive Horsepower, (purchased in 1927) completed, 1928-29.

Equipment in the Cold Strip Mill augmented by the addition of annealing furnaces, normalizing furnaces, pickling machines, levelers, slitters and edgers during 1928-29.

2-Basic Open Hearth Furnaces, 1-275-Ton and 1-350-Ton, completed, 1928.

Blast Furnace Stack #2, remodeled, 1929.

1-Turbo-Blower 80,000 C.F.M., installed at Blast Furnaces, 1929.

Blast Furnace Stack #1, remodeled, 1930.

1-28" Rail and Structural Mill, driven by 2-Motors, 5,250 Main Drive Horsepower, installed, 1930.

24-Koppers-Becker By-Product Coke Ovens, completed, 1930.

Equipment for cleaning blast furnace gas to burn in coke ovens, installed, 1929.

1-5"x32"x38"-Steckel 4-High Cold Strip Mill, driven by 2-Motors, 1,000 Main Drive Horsepower, installed, 1930.

6-150-Ton Basic Open Hearth Furnaces, enlarged to 250-Ton, 1930.

The Semi-Continuous Strip Mill consisting of 20" 2-High 6-Stands and 16"-2-High 6-Stands was rearranged to permit rolling rounds, squares and angles during 1931.

1-Continuous Pickling Machine, installed in 48" Hot Strip Mill, 1931.

Warehouses for the Tin Plate Department and Merchant Mill, constructed, 1931.

Lacquer Department added to Tin Mill with furnaces and painting machines, 1931.

1-3"x24"x20"-4-High Steckel Cold Strip Mill, installed, 1932.

1-5"x27"x28"-4-High Steckel Cold Strip Mill, driven by 1-Motor, 600 Main Drive Horsepower, installed, 1933.

1-16"x42"x38"-4-High Tandem Cold Mill for rolling hot rolled coiled strip to tin plate gages, driven by 4-Motors, 2,400 Main Drive Horsepower, constructed, 1933.

West Leechburg Steel Company

West Leechburg, Pa.

1-12"-2-High 14-Stand Hot Continuous Strip Mill, driven by 7-Motors, 7,800 Main Drive Horsepower, (purchased in 1929) completed, 1930.

1-20"-4-High Steckel Cold Strip Mill, installed, 1930.

3-7½"-4-High Steckel Cold Strip Mills, installed, 1930.

West Virginia Rail Company

Huntington, W. Va.

16"-3-High 1-Stand Roughing Bar Mill, remodeled and equipped with 1-Motor, 600 Main Drive Horsepower, 1928.

12″-3-High 5-Stand Bar Mill, remodeled and equipped with 1-Motor, 1,000 Main Drive Horsepower, 1928.

12″-3-High 2-Stand Bar Mill, remodeled and equipped with 1-Motor, 500 Main Drive Horsepower, 1928.

5-10-Ton Cranes, installed, 1930.

Wheeling Steel Corporation

Beech Bottom, W. Va.

Terne Plate Department rebuilt to permit producing 29,000 tons annually, 1928.

Benwood, W. Va.

Lap and Butt Weld Tube Mills, rebuilt, 1928.

Portsmouth, Ohio

1-Wire Fence Machine, installed, 1928.

Track Spike Department, added, 1928.

Blast Furnace Stack #1, remodeled, 1931.

Steubenville, Ohio

Blast Furnace Stack #2, remodeled, 1928.

Blast Furnace Stack #1, remodeled, 1929.

1-Continuous Hot Strip Mill consisting of 1-45″ 2-High 1-Stand Universal Blooming and Slabbing, the horizontal rolls driven by 1-Motor, 7,000 Main Drive Horsepower, the vertical rolls by 1-Motor, 1,650 Main Drive Horsepower, 1-21″x60″-2-High 2-Stands, driven by 1-Motor, 4,000 Main Drive Horsepower, 1-21″x44″x60″-4-High 3-Stands, driven by 3 Motors, 5,400 Main Drive Horsepower, 1-18″x44″x60″ 4-High 6-Stands, driven by 6-Motors, 15,800 Main Drive Horsepower and three vertical edging stands, completed, 1929.

Cold Mills for rolling hot rolled coiled strip to tin plate gages consisting of 2-20″x44″x48″-4-High 3-Stand Tandem Trains, 1-20″x44″x48″-Single Stand, driven by 7-Motors, 3,500 Main Drive Horsepower, 2-27″x48″-2-High 1-Stand and Pickling Machines, Annealing Furnaces, levelers, etc., completed, 1929.

Yorkville, Ohio

The first departure in the manufacture of tin plate was made by the installation of a mill to reduce hot rolled coiled strip consisting 1-18″x30″x32″ 4-High 4-Stands arranged in Tandem, 1-18″x30″x32″ 4-High Single Stand and 1-27″x48″-2-High Single Stand with washers, electro cleaning tanks and tinning equipment during 1929.

1-20″x44″x42″ Tandem Cold Mill for rolling tin plate gages, driven by 6-Motors, 3,400 Main Drive Horsepower, will be constructed during 1934.

Wickwire Spencer Steel Company

Buffalo, New York

1-Blast Furnace Stack "Y", remodeled, 1929.

Witherbee Sherman Company

Port Henry, New York

Blast Furnace Stack #2, remodeled, 1929.

Woodward Iron Company

Woodward, Alabama

Blast Furnace Stack #1, remodeled, 1928.

Blast Furnace Stack #2, remodeled, 1929.

Blast Furnace Stack #3, remodeled, 1928.

1-Pig Caster with 175-foot Strands, installed, 1930.

Blast Furnace Stack #1, equipped with revolving distributor, burners and automatic combustion control, 1932.

Worth Steel Company

Claymont, Delaware

1-Jobbing Sheet Mill, driven by 1-Motor, 1,000 Main Drive Horsepower, completed, 1930.

Youngstown Sheet and Tube Company

Brier Hill Works, Youngstown, Ohio

Blast Furnace Stack #2, remodeled, 1929.

2-Ingot Jarring Machines to eliminate piping, installed, 1929.

Open Hearth Furnaces equipped to burn fuel oil and tar, 1929.

Blast Furnace Boilers equipped with stokers to burn coke braize, 1929.

Continuous Pack and Pair Furnaces and Roller and Catchers Tables, installed on Sheet Mills, 1930.

4-Continuous Billet Heating Furnaces, remodeled, 1930.

1-Electric Weld Tube Mill to produce tubes 16″ to 26″ utilizing curved skelp from Plate Mills, completed, 1930.

New equipment to be added to the electric weld mill during 1934 to increase range of pipe sizes from present capacity of 26 to 18 inches on down to 8⅝ inches, will consist of the following:

A cleaning machine to clean the plate before forming, roll equipment in the present forming machine to take care of 8⅝ inches to 16 inches O.D., a welding machine, located between the present forming machine and the present welding machines to take care of 8⅝ inches to 16 inches O.D., roll equipment for sizing and straightening machines to take care of 8⅝ inches to 16 inches O.D., necessary changes in cutting-off machinery and testing machines to take care of 8⅝ inches to 16 inches O.D. The balance of the equipment of the present electric weld mill will be suitable for the manufacture of the newer smaller sizes.

Campbell, Ohio

Blast Furnace Stack "D", remodeled, 1928.

Blast Furnace Stack "A", remodeled, 1929.

1-40"-2-High 1-Stand Blooming Mill, equipped with 1-Motor, 7,000 Main Drive Horsepower, 1929.

1-10"-2-High 10-Stand Continuous Skelp Mill, equipped with 1-Motor, 2,000 Main Drive Horsepower, 1929.

1-18"-2-High 10-Stand Continuous Billet Mill, equipped with 1-Motor, 5,000 Main Drive Horsepower, 1929.

1-18"-2-High 8-Stand Continuous Sheet Bar Mill, equipped with 1-Motor, 5,000 Main Drive Horsepower, 1929.

The Butt Weld and Seamless Tube Mills were enlarged and re-arranged, 5-Motors, 3,650 Main Drive Horsepower being added, 1929.

The tapping side of the Open Hearth Department was enlarged to permit pouring 125-ton heats during 1930.

1-Basic Open Hearth Furnace, equipped with automatic combustion control, 1930.

1-18,000 Kva. Turbo-Generator, installed in Blast Furnace Power Plant, 1930.

1-10-Ton Inverted Ingot Stripper, installed, 1930.

Ingot Jarring Machine to eliminate pipe in ingots, installed, 1931.

Continuous Pack and Pair Furnaces, Roller and Catcher Tables, installed at Sheet Mills, 1931.

1-200-Ton Ladle Crane, installed, 1931.

The Seamless Tube Mill was remodeled, new piercers, reelers, sizers, upsetters and furnaces during 1931.

1-3-High Hot Sheet Mill, installed, 1932.

Hubbard, Ohio

1-Blast Furnace Stack #1, remodeled, 1928.

Indiana Harbor, Indiana

Blast Furnace Stack #2, remodeled, 1928.

1-15-Ton Ore Bridge, installed, 1929.

1-Sintering Plant with an annual capacity of 250,000 tons, installed, 1929.

Blast Furnace Stacks #1 and #2, equipped with Hot Blast Control, 1930.

2-4-Hole Producer Gas Fired Soaking Pits, installed, 1929.

1-Motor, 8,000 Main Drive Horsepower, installed on remodeled 35"-2-High 1-Stand Reversing Blooming Mill, 1930.

1-24"-18"-10-Stand Continuous Billet and Sheet Bar Mill, driven by 3-Motors, 11,000 Main Drive Horsepower, installed, 1930.

3-Continuous Producer Gas Fired Heating Furnaces, installed, 1930.

1-14"-12"-10"-Merchant Mill, driven by 6-Motors, 5,900 Main Drive Horsepower, installed, 1930.

1-18"-14"-12-Stand Merchant Mill, driven by 3-Motors, 8,600 Main Drive Horsepower, installed, 1930.

The Open Hearth Department was enlarged by the addition of 3-250-Ton Basic Open Hearth Furnaces, Boilers to utilize waste heat, Charging Crane and 2-Ladle Cranes on tapping side, 1930.

Continuous Pack and Pair Furnaces, Roller and Catcher Tables were installed in Tin Mills, 1932-33.

1-18"x49"x42"-4-High Single Stand Cold Mill for rolling tin plate gages from hot rolled coiled strip, driven by 3-Motors, 3,200 Main Drive Horsepower, installed, 1933.

South Chicago, Illinois

70-Koppers-Becker By-Product Coke Ovens, completed, 1928.

Blast Furnace Stack #5, rebuilt, 1929.

Equipment to recover oil at Coke Oven By-Product Plant, installed, 1929.

1-10-Ton Ore Bridge, installed, 1929.

2-Blast Furnace Gas Cleaners, installed, 1930.

Sintering Plant for flue dust, installed, 1931.

Struthers, Ohio

Plant for manufacture of track spikes, completed, 1933.

A. I. & S. E. E.
CONVENTION
AND
EXPOSITION
CLEVELAND, OHIO
September 18-19-20, 1934

Iron and Steel Engineer Index For 1933

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ITEMS OF INTEREST

PERSONNEL CHANGES

C. A. Kral, formerly superintendent of the Blooming Mills, Bar and Hot Strip Mills, has been appointed assistant general manager of the Steubenville, Ohio plant of the Wheeling Steel Corporation.

C. A. KRAL.

Mr. Kral is an active member of the Association of Iron and Steel Electrical Engineers and is at the present time serving on the Association's National Committee devoted to Developments in Rolling Mill Practices.

The membership of the Association extends to Mr. Kral their congratulations on his elevation to his new capacity and wishes him continued success.

F. H. Dyke, formerly assistant superintendent of the Blooming Mills, Bar and Hot Strip Mills of the Steubenville, Ohio plant has been appointed superintendent, succeeding Mr. C. A. Kral.

C. M. Thompson, formerly products engineer in charge of the Carboloy and Circular Saw Divisions of the Henry Disston & Sons, Inc., Philadelphia, has been transferred to the Sales Department in charge of Metal Saw and Carboloy sales.

Mr. Thompson graduated in 1915 from the Mechanical Engineering Department of the University

C. M. THOMPSON, JR.

of Pennsylvania. He entered the employ of the Philadelphia Electric Company. Served in the World War and was discharged in April 1919 and returned to the employ of the Philadelphia Electric Company.

In April 1920 he entered the employ of the Henry Disston & Sons, Inc., in the Engineering Department. In November, 1924 he was promoted to plant engineer and served in this capacity until August, 1929. Then he was transferred to Production department in charge of the Carboloy and Circular Saw Divisions, from there to his present new position in the sales department.

Mr. Thompson is an active member of the A. I. & S. E. E. and last year served as Chairman of the Philadelphia Section, also serving on the Board of Directors of the Association this year. The membership of the Association extend to him their best wishes for his continued success in his new capacity.

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As announced in the December issue of the Iron and Steel Engineer G. A. White, an active member of the A. I. & S. E. E., has been appointed Vice President in Charge of Production of the Follansbee Brothers Company plants, this covering operations at both the Follansbee, W. Va. and Toronto, Ohio, plants, the management of which plants remains as heretofore, with Mr. Lake at Follansbee and Mr. Marlier at Toronto.

G. A. WHITE

Mr. White has had a broad experience in Open Hearth practice, Sheet, Strip and Tin Plate production. He was a pioneer in the normalizing of Sheet Steel for deep drawing requirements and has assisted the Industry to a considerable extent in the rapid improvement which has been accomplished in the quality of Electrical Sheet Steel.

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Harry W. McQuaid, nationally known authority on carburizing steels and case hardening methods, and collaborator in the development of the McQuaid-Ehn carburizing test, has joined the metallurgical staff of Republic Steel Corp., Youngstown, Ohio. He will devote his time to research and development work.

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T. E. Millsop, formerly assistant to the president of Weirton Steel Co., Weirton, W. Va., has been elected a vice president of the company. Other Weirton changes effective Jan. 1 are:

E. J. Anglin, formerly superintendent of steelworks, has been appointed general superintendent, to succeed G. W. Vreeland. The former has been affiliated with the company for 19 years.

J. S. Williamson has been appointed assistant general superintendent; H. E. McDonnell manager and M. Guirand assistant manager of the steelworks.

E. R. Church has been named superintendent of the blooming mills, and A. M. Baker superintendent of blast furnaces.

Henry Rudolph has been appointed assistant superintendent of blast furnaces, and Luther Renfrew assistant superintendent of the company's coke works.

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Willis Larimer King, vice president and member of the executive committee of the Jones & Laughlin Steel Corp., Pittsburgh, has resigned, but will continue to serve as a member of the board of directors. Regarded affectionately as the dean of the American steel industry, he has been active with Jones & Laughlin for 64 of his 83 years, during which time the company's production has expanded from 30,000 tons of puddled iron annually to the present capacity of 3,600,000 tons of steel ingots.

OBITUARIES

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David Kendall, general manager, Alliance Machine Company, Alliance, Ohio, died in Hartford, Conn., January 2. Coming to this country from England in 1887 he first was associated with the Morgan Engineering Company in Alliance, advancing to general superintendent. In 1901 he resigned and became associated with the newly formed Alliance Machine Company remaining with the firm from its inception to the present time. Besides being general manager at the time of his death, he was a director of the concern. Mr. Kendall had attained international recognition in the steel industry. He became one of the outstanding men in the development of electric overhead traveling cranes used in steel mills and he also took an active interest in the development of forging equipment. Mr. Kendall took an active interest in the A. I. & S. E. E. and presented many discussions which were valuable additions to our Proceedings.

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T. A. Jackson, formerly lubrication engineer, Keystone Lubricating Company, Pittsburgh District, died December 27 following a traffic accident. Mr. Jackson was well known throughout the Iron and Steel Industry and he had a host of friends among the steel mill engineering executives and operating officials.

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Clyde M. Hickle died at his home in Columbus, Ohio on Saturday, December 30. At the time of his death Mr. Hickle was vice president and general manager of The Automatic Reclosing Circuit Breaker Company, having been connected with this company for the past fourteen years. He was active in the affairs of the Association of Iron and Steel Electrical Engineers and served on several National Committees since he joined the Society in 1918.

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C. O. Norstrum, sales engineer, Keystone Lubricating Company, Philadelphia, Pa., died December 28. Mr. Norstrum was widely known throughout the Iron and Steel Industry and had presented many valuable discussions on lubrication subjects before the A. I. & S. E. E.